

ABSTRACT

IVY, ROBERT LEE (LEE). Case Study on the Department of Horticultural Science Academic Program's Impact on Recent Undergraduates and Development of Skills and Aptitudes for Subsequent Career Success (Under the direction of Dr. Joy Morgan).

To enter horticulture as a profession, students must be competent in science, theory, art, and the convergence and application of each. The purpose of this study was to explore the perception of graduates from the Department of Horticultural Science focusing on their undergraduate experiences, and those factors and opportunities designed to enrich learning, thus providing insight into how those experiences influenced readiness for a career in horticulture. In addition, exploration into a student's abilities, confidence, past performance, perceived performance, and skill attainment level is considered when determining which factors and experiences need to be emphasized in similar programs to develop necessary skill sets for successful careers in the horticulture industry.

Three intricately linked aspects of career development are detailed in the Social Cognitive Theory of Career and Academic Interest, Choice, and Performance (Lent, et al., 1994). These include (a) the formation and elaboration of career-relevant interests, (b) the selection of academic and career choice options, and (c) performance and persistence in educational and occupational pursuits. The framework builds on Social Cognitive Theory at the general level and personal agency combined with other factors that affect the career development process (Bandura, 1986). This case study queried ten recent graduates of the Department of Horticultural Science at NC State University in two focus groups followed by individual interviews. Participants perceived NC State provided them the opportunities to enter a career in the horticultural field crediting this to the impact of academic engagement and training, the value of student engagement and opportunities, faculty engagement and industry

relationships, and professional skill set development. This study found graduates perceived high-impact experiences enhance graduate readiness, specific courses may benefit from being face-to-face learning rather than online, the environment created by faculty is critical to learning and career preparation, and hands-on training and proper curricular structure aids in yielding prepared students.

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Case-Study on the Department of Horticultural Science Academic Program's Impact on Recent Undergraduates and Development of Skills and Aptitudes for Subsequent Career Success

by
Robert Lee (Lee) Ivy

A dissertation submitted to the Graduate Faculty of
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DEDICATION

To my wife, Sarah, for her dedication and support to me, our family and so many others.

To my mother and late father for their dedication to their children and encouragement to honor
Jesus Christ.

To him who is able to keep you from falling and to present you before his glorious
presence without fault and with great joy — to the only God our Savior be glory, majesty, power
and authority, through Jesus Christ our Lord, before all ages, now and forevermore! Amen.

— Jude 1:24-25

BIOGRAPHY

R. Lee Ivy is the Director of the Agricultural Institute (AGI) and Assistant Director of Academic Programs in the College of Agriculture and Life Sciences at NC State University. He has been a post-secondary educator since 2001.

Childhood experiences with peaches, vegetables, cattle, and ornamental plants sparked his interest and subsequent love of agriculture. His interest in a career in education grew from his respect for teachers throughout his life who inspired effort, allowed for challenges, and encouraged high personal achievement. He continues to enjoy anything in creation from hunting and hiking to cultivating his vegetable garden at home. Recent hobbies have him beekeeping and raising quail. His efforts on the home front usually include his wife of 20 years and three kids. Despite many accomplishments, serving God and his family continues to be his greatest passion.

From 2012-2021, Lee taught in the Department of Horticultural Science at NC State University in areas of fruit & vegetable production, ornamental and turf weed & disease management, landscape maintenance, landscape construction courses, introductory horticulture, and home horticulture via distance education. He served as co-advisor for the Horticulture Competition Team and co-hosted the National Collegiate Landscape Competition (NCLC) in 2015 and 2022. Before his experience at NC State, he taught at Sandhills Community College from 2001-2012.

He holds degrees in horticulture from the University of Tennessee and NC State University, is a licensed landscape contractor, is a member of the International Plant Propagators Society – Southern Region, is a certified pesticide applicator, and a member of the NC Nursery and Landscape Association.

Most of his teaching has been traditional face-to-face instruction, but he also developed an award-winning online educational platform of project-based horticultural activities for college credit through the undergraduate certificate program. He developed hands-on teaching activities and experiences for his students in conjunction with industry and collegial partnerships. His efforts include recruiting the next generation of agricultural professionals through personal contact, 4-H, the FFA Organization, and various career fairs. He intends to educate about sustainable agricultural systems, safe food production, and a productive and rewarding livelihood. In addition to administrative duties, he networks with agricultural industry employers to foster job and internship opportunities for students.

Lee recently led his team at the NCSU Agricultural Institute through the creation of the AGI Strategic Plan focused on recruitment, impactful curriculum, professional networking, and economic support. Additionally, he and his team are managing a million-dollar grant from the Golden Leaf Foundation focused on integrating students into meat and poultry processing careers in Tier 1 & Tier 2 counties of North Carolina. In 2020, Lee co-authored the textbook, “Landscape Design, Installation and Management” published by Goodheart-Wilcox and released a second edition in 2024.

ACKNOWLEDGMENTS

The pursuit of this degree was a family effort. My father, Robert, completed two degrees and some credit toward a doctoral degree. He frequently encouraged me to pursue one, but I prioritized other opportunities and interests. Once I decided it was time to pursue the degree, he had passed. I'm sure he would have enjoyed seeing me complete this challenge. My mother, Janis, was apprehensive about me entering a doctoral program since my experience obtaining my master's degree produced much anxiety. She is and has always been extremely supportive with prayers and encouragement and I will always be grateful to her.

Bryce and Sue, my in-laws, have also been wholly supportive and encouraging through this process, however, I am sure they have chuckled watching me pursue the degree I said I never would. They never cast doubt in my abilities. For that I am thankful.

As I was finishing the writing process, I sent my wife Sarah a meme of a marathon runner being carried over the finish line by another runner since she helped carry my thoughts and research into a cohesive narrative. At the beginning of this journey, I promised her that the pursuit of this degree would not compromise time for our growing family. Thankfully, I was able to keep that promise, and we grew together through this process. Thanks, Babe!

Lane, Tate, and Paige continue to inspire me in their dedication to academics, friendship, and helpfulness in our family and community. I enjoy being their dad. Their laughter and fun-loving spirits bring me great joy. It looks like I'll finish this challenge a year before high school graduations begin. I love each of you!

Joy, you took me on as a graduate student while knowing I had a full-time career in education and a growing family. You have provided direction at every turn, encouragement in

the challenging times, and hope for a successful future. Thank you for inspiring me and so many in their educational pursuits.

Wendy, you challenged me in qualitative research and have always been a professional and encouraging colleague. I admire your passion for learning, education, and students. Thank you for helping me with this!

Charlotte, you, and I have watched each other progress professionally and personally in horticulture. Knowing you recently moved through this same process inspired me and your questions and challenges encouraged me to be better. Thank you!

Wayne, I greatly appreciate your friendship and encouragement. Mentorship during your time as a department head was an experience that I'll never take for granted. I am one of many who admire your quiet and enthusiastic leadership. One day, I aspire to be able to rock an all-season hat as well as you do!

This journey has required patience from my team in the Agricultural Institute office, especially in the closing days of dissertation preparation. Alyssa, Kayla, Kaylee, and Michaela, thank you for encouraging me and working with my desire to gain this degree. I appreciate your passion and intentionality with students, and I look forward to continuing to serve them together.

TABLE OF CONTENTS

LIST OF TABLES	x
LIST OF FIGURES	xi
CHAPTER 1: INTRODUCTION	1
The Horticulture Industry	1
The Department of Horticultural Science at North Carolina State University	3
Essential Standards of Horticulture	4
Statement of the Problem.....	5
Purpose of the Study	6
Research Questions	6
Definition of Terms.....	7
Limitations of the Study.....	8
Assumptions.....	9
Chapter Summary	9
CHAPTER II: REVIEW OF LITERATURE	10
Introduction.....	11
Theoretical Framework.....	13
Review of Related Research	15
Degree Deliverables	15
High Impact Experiences in Higher Education	16
Academics.....	16
Internships.....	17
Field Experiences.....	18
Travel	18
Undergraduate Research	19
Student Success Initiatives/Careers	19
Workplace Readiness.....	20
Chapter Summary	22
CHAPTER III: METHODOLOGY	23
Introduction.....	23
Methodology Highlight.....	24
Reflexivity Statement.....	24
Rationale for Qualitative Study	26
Research Design.....	27
Participant Selection	28
Pilot Participant.....	29
Data Collection	30
Data Analysis	32
Qualitative quality.....	33
Chapter Summary	35
CHAPTER IV: RESULTS	36

Participant Descriptions	36
Research Question 1	39
Theme 1. Preparation for success	40
Theme 2. Repeat customer mentality.....	42
Research Question 2	45
Theme 1. Academic Engagement and Training.....	45
Rigor and Breadth of Lecture and Laboratory Instruction.....	46
Undergraduate Research	48
Internships and Other Work Experiences	49
Hands-on Learning.....	51
Face-to-face Instruction	53
Theme 2. Student Engagement and Opportunities	57
Travel	57
Clubs and Teams.....	58
Theme 3. Faculty Engagement and Relationships	60
Learning Environment	60
Networking and Employment Opportunities	61
Theme 4. Professional Skill Set Development	63
Technical Skills.....	63
Soft Skills.....	67
Personal Growth.....	68
Communication.....	69
Chapter Summary	71
CHAPTER V: CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS.....	72
Introduction.....	72
Summary of the Study and Procedures.....	72
Purpose of the Study	72
Research Questions.....	72
Procedures.....	73
Summary and Conclusions	73
Conclusions Regarding Research Question 1	73
Conclusions Regarding Research Question 2	74
Implications.....	76
Connections to Theoretical Framework.....	82
Recommendations for Future Practice.....	83
Recommendations for Future Research	84
REFERENCES.....	86
APPENDICES.....	98
Appendix A - Participant chart	99
Appendix B - IRB Interview Approval.....	100
Appendix C - Request for Participation Letter	101
Appendix D - Participant Interview Protocol	103
a. research questions	103
b. memo to participants and follow-up request.....	104

Appendix E - Coding protocol (focus group & follow-up via email).....106

LIST OF TABLES

Table 1	Approach for Gaining Information from Study Participants	31
Table 2	Skills Gained by Alumni of the Department of Horticultural Science at NC State University Between the Years of 2015-2022. Model of How Basic Career Interests Develop Over Time	44

LIST OF FIGURES

Figure 1.1	The Economic Impact of Horticultural Sales in 2019 Across the United States of America.....	2
Figure 2.1	Model of How Basic Career Interests Develop Over Time. This Model Highlights Cognitive and Behavioral Influences During Childhood and Adolescence	11
Figure 2.2	The Pragmatic Approach of Learning through a Hands-on Approach is Introduced in this Diagram.....	15

CHAPTER 1

INTRODUCTION

Throughout the United States, educators are tasked with preparing graduates who will enter the workforce with the skills and knowledge needed to acquire and succeed in a career. Departments, educators, and faculty design curriculum and instruction in hopes of meeting the needs of industry demand as well as providing opportunities that will engage students in critical thinking and high-impact experiences. As the needs and demands change with society, careers often must reflect and adapt to these changes. Research and evaluations focusing on career preparedness allow educators to make needed adjustments to curricula that reflect graduates who are currently in the workforce. The horticulture industry is one such industry that is multi-faceted and offers a variety of career opportunities for graduates with a horticultural background.

The Horticulture Industry

Horticulture, by definition, is the science and art of growing fruits, vegetables, flowers, or ornamental plants (Merriam-Webster, 2023). In the United States, the horticulture industry includes ornamental plants, fruits and vegetables, and floriculture crops with the landscape industry alone accounting for \$182 billion in 2024 (Mordor Intelligence, 2024). Furthermore, the USDA reports that the economic impact of the floriculture industry in the United States is \$13.8 billion (*Newsroom*, 2019) as seen in Figure 1.1. The United States can produce a wide variety of fruits and vegetables as well as many specialty crops. The diversity of climactic conditions, variability of soils, and infrastructure and transportation make the United States economically competitive in domestic and international markets.

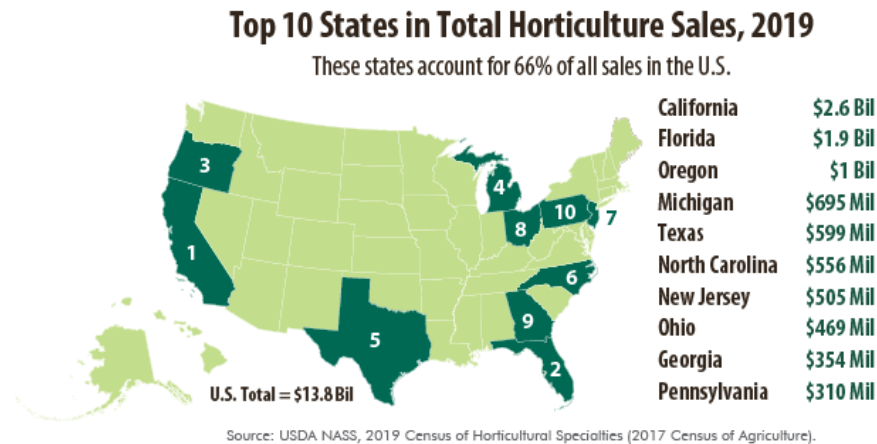


Figure 1.1 The Economic Impact of Horticultural Sales in 2019 Across the United States of America.

In North Carolina, horticultural crop production has an annual impact of \$556 million with horticultural crops making up 11.8% of North Carolina farm cash receipts (Webb, 2022). Combined, agriculture and agribusiness, including food crop production, are the top value-added sectors of the state’s economy contributing financially and supporting 663,000 jobs (Walden, 2015). Like the United States, climate and soil diversity exist within North Carolina allowing a variety of crops to be produced with an extensive transportation system and shipping ports in the state and adjacent states. One-third of the population of the United States is within 600 miles of North Carolina which creates markets for agricultural commodities and the NC Green Industry (World Population Review, 2023).

In addition, North Carolina has a rich history of horticulture education in high schools and post-secondary educational institutions. Educators seek to provide innovative educational programming to promote these areas as exciting and rewarding employment opportunities. To continue to grow the North Carolina horticulture industry, including greenhouse, nursery, floriculture, sod, Christmas tree producers, and related landscaping, industry trades constantly

need motivated and trained employees (Higgins, 2018). In addition to this, the North Carolina Green Industry continues to need qualified employees in landscape design, installation, and management (Baker & Robinson, 2019). These interest areas provide exciting and rewarding employment opportunities with upward career mobility (Goecker et al., 2015).

Agriculture-related fields, especially horticulture, emphasize scientific aspects, gaining interest from urban and minority populations otherwise unaware of agriculture-related career opportunities (Fontanier, 2019). Like nationwide labor shortages in agriculture, the demand is higher than the talent pool. Due to this, the industry is limited in areas of growth and opportunities for advancement, thus providing graduates with a tremendous variety of career opportunities.

The Department of Horticultural Science at North Carolina State University

To enter horticulture as a profession, students must be competent in science, theory, art, and the convergence and application of each. Options for study and career paths exist individually, such as, a plant breeder focused on the science of growth traits, nutrient content or propagation methods, or an entrepreneur wishing to provide landscape design and management. Regardless of a student's interest area, programs of study are required to deliver content through relevant and engaging methods. As a part of a land-grant institution, the Department of Horticultural Science at NC State University has been recognized for meeting the needs of the industry while also aiding in the success of its students. Since 2000, over 100 organizations have awarded the department's professors, researchers, and extension professionals for their work and efforts. Many activities and initiatives in the department are designed to enrich the learning experience and employability skill development for undergraduate students (Crawford, 2019).

The Department of Horticultural Science historically integrates perceived high-impact practices during students' academic tenure. Examples of high-impact practices that promote

deep learning through student engagement can include first-year seminars and experiences, common intellectual experiences, learning communities, writing-intensive courses, collaborative assignments, and projects, undergraduate research, diversity/global learning, service learning, community-based learning, internships, capstone courses, and projects (Kuh and O'Donnell, 2013). The Department of Horticulture at NC State University uses each of these to strive for career readiness as well as extracurricular clubs and competitions at both the local and national levels which also provide travel opportunities. The department reports graduates enter career areas of landscape design, plant production systems, plant breeding, and biotechnology with greater than 80% job placement upon graduation.

Essential Standards of Horticulture

For undergraduate degree programs in horticulture to meet the needs of the horticulture industry, the industry and academic institutions must agree on the benchmark skills and aptitudes needed in graduates seeking employment. According to Basinger, McKinney, and Auld (2009), horticulture and landscape-related graduates should possess skills and aptitudes in plant nomenclature, proper plant selection, soil analysis, fertilizer selection and application, pruning of woody plants, and landscape plan interpretation. Basinger's (2009) study surveyed 22 horticulture educators in a three-round Delphi study to develop a list of competencies. The study yielded 108 specific learning outcomes, 41 technical competencies of horticulture, 34 life science technical competencies, and 33 professional competencies, and these competencies were ranked by level of acceptance by the educators. Pritts and Park (2013) detailed proposed learning outcomes for four-year horticulture programs in the United States, providing guidance for institutions' local conditions and capacities as well as plant-science majors. The outcomes are knowledge acquisition, knowledge integration, synthesis, creativity and problem-solving, communication, and demonstration of professionalism and proficiency.

As part of a special topics course in the Fall of 2020, I investigated those benchmarks and the curriculum taught at institutions. Through interviews with industry professionals and educators from comparable degree-granting institutions, responses were compared to three publications. This review identified the 10 essential standards of horticulture listed below, which represent standards found in each of the three sources (National Council for Agricultural Education, 2021; Basinger, et. al., 2009; and Pritts, & Park, 2013).

1. Humans and Horticulture
 - How humans impact plants and the environment
 - The effect of horticulture on humans
2. Plant Identification
 - Anatomical and botanical classifications
3. Plant Growth and Development
 - The main plant functions, processes and products, and management of plants
4. Soils and Substrates
 - The foundational growing component
5. Plant Nutrition and Water Management
 - Intake and functions of nutrients
 - Water functions and effects inside and outside of the plant
6. Propagation/Plant Breeding
 - How plants are selected and duplicated
7. Production Systems and Management of Plants
 - Ways to produce plants and maintain them through life cycles
8. Plant Pests
 - Biotic and abiotic factors
9. Marketing
 - The business side of horticulture
10. Professionalism
 - Decision-making, leadership, critical thinking, and ethics

Statement of the Problem

Berle (2007) surveyed horticultural companies across the United States to identify differences between preparation in academic institutions and on-the-job training and preferred high-quality individuals with leadership skills and character over those with technical skills. In recent years, shortages in the agricultural workforce have been a challenge, specifically, the North Carolina Green Industry continues to need motivated and trained employees in landscape

design, installation, and management (Baker & Robinson, 2019). These interest areas provide employment opportunities with upward career mobility. Horticultural degree programs are intentionally investing resources in high-impact practices with employability skill development as a common focus for university educational programs (Crawford, 2019); however, additional research is needed to understand what experiences, courses, and opportunities are perceived to impact career readiness. As we continue to strive to meet the growing needs of the industry, workforce shortages, and well-qualified graduates, the research gap focused on career readiness specific to the horticulture industry needs to be addressed to ensure that faculty and programs are utilizing those perceived best practices to further development the knowledge and skills needed to enter a career.

Purpose of the Study

The purpose of this study was to explore the perception of graduates from the Department of Horticultural Science and their perceived career readiness. The focus was on their undergraduate experiences and specific factors and opportunities that enriched learning (if any), thus providing insight into how those experiences influenced readiness for a career in horticulture.

In addition, through the data collected, findings can foster future research and evaluations to guide enhancements or initiatives within a horticulture degree program to accommodate industry-related technological advances and student learning needs.

Research Questions

Two questions guided this study:

1. What are the perceptions of recent graduates of the Department of Horticultural Science at North Carolina State University about their preparedness to enter the

horticultural field?

2. What were the perceived major experiences that allowed them to be successful upon entering their careers?

Definition of Terms

For this study, the following terms are defined:

Career success – Includes but is not limited to the creation of financial stability, enjoyment in work and personal affairs, and the freedom to make multiple choices that affect the conditions.

Core competencies - Skills and aptitudes needed by graduates including general plant science knowledge, writing/verbal skills, problem-solving/decision-making, and professional skills.

Field experience - A set of events and opportunities given to a student that allows for the practical application of learned information.

Graduates - Students graduating from the Department of Horticultural Science at NC State University from 2015 - 2022 before the administration of the focus groups and individual interviews.

High-impact experience - One or more events that lead to an elevated understanding or comprehension of principles and protocols within an area of academic discipline.

Horticulture Industry - In the United States, the horticulture industry includes ornamental plants, fruits and vegetables, and floriculture crops, with the landscape industry alone accounting for \$183 billion in 2024 (Mordor Intelligence, 2024).

Internship - A supervised experience within an established organization that allows students to learn about professional conduct and business practices firsthand.

Undergraduate research - A student experience within a specific area of scientific research, usually within a faculty member's research expertise or academic working group.

Workplace readiness - The measure of a person's ability to apply skills and aptitudes necessary for a specific career.

Limitations of the Study

1. For this study, the researcher asked the Department of Horticultural Science at NC State University for a list of recent graduates with varied undergraduate experiences and industry positions. Participants were selected by the researcher because of their various involvement in activities such as club organizations, travel competitions, coursework, and internships as well as those who mainly attended classes but with no extra involvement. In addition, the researcher selected based on the variety of current careers, gender, and geographical location.
2. Seventeen were identified and invited to participate through LinkedIn messaging. Some of the former students indicated they were not very active on social media and saw my request after the researcher had begun the study. Others have yet to respond. Those ten who participated received the LinkedIn message.
3. Not all participants had the same educational experience related to content delivery. Some experienced the challenges of a forced pivot to online learning due to the COVID-19 pandemic and some faculty had two weeks to prepare to deliver content through this method.
4. The findings are limited to the responses of this group of ten alumni and careful consideration is given to their unique characteristics, which prevents generalizations outside this group of former students.
5. Further, the findings and conclusions of this study are limited to the researcher's interpretation. Interviews were the primary source of data collection, and the researcher analyzed and coded them.

Assumptions

The researcher while conducting this study made the following assumptions:

1. Participants could determine the necessary skills and aptitudes that lead to their perceived career success.
2. Answers to the questions asked by the researcher during the interview process are assumed to represent the individual and stories, examples, and other information are truthful.

Chapter Summary

Qualified graduates are needed in the agricultural workforce. Many employment opportunities exist in all facets of agriculture, and educational institutions must adequately prepare students for a variety of career paths. Agricultural programs strive to intentionally direct students to impactful and transformative educational experiences that result in skills and aptitudes transferable to their future professions. Evaluating existing horticultural programs and examining the experiences that shaped whether students felt prepared for their career in the horticulture industry will aid in bridging the existing workforce gap and help advance agricultural production. This study sought to explore the perception of graduates from the Department of Horticultural Science and their perceived career readiness. The focus was on their undergraduate experiences and specific factors and opportunities that enriched learning (if any), thus providing insight into how those experiences influenced readiness for a career in horticulture.

CHAPTER 2

THEORETICAL FRAMEWORK AND REVIEW OF RELATED LITERATURE

Introduction

The purpose of this study was to explore the perception of graduates from the Department of Horticultural Science and their perceived career readiness. Focus was on their undergraduate experiences, specific factors, and opportunities that enriched learning (if any), thus providing insight into how those experiences influenced readiness for a career in horticulture. In addition, an exploration into a student's abilities, confidence, past performance, perceived performance, and skill attainment level was taken into consideration when determining which factors and experiences need to be emphasized in similar programs to develop necessary skill sets for successful careers in the horticulture industry. For this study, Lent's (1994) Social Cognitive Theory of Career and Academic Interest, Choice, and Performance was used. The model is explained in this chapter, as well as literature reviewed in the following areas:

- Horticulture Degree Deliverables
- High-Impact Experiences in Higher Education
 - Academics
 - Internships
 - Field Experiences
 - Travel
 - Undergraduate Research
- Student Success Initiatives/Careers
- Workplace Readiness

Theoretical Framework

The Social Cognitive Theory of Career and Academic Interest, Choice, and Performance (Lent et al., 1994) was used as the theoretical framework for this study. It is related to but more applicable than constructivist approaches, where an individual develops problem-solving strategies through experiential learning (Doolittle et al., 1999). Also related is Rogers' (1969) approach to learning from meaningless to significant experiential learning but the model does not include the dynamic nature of self-efficacy. The model presented by Lent et al. (1994) lends itself to the dynamic nature of how career interests develop over time from childhood, through adolescence, and into early adulthood when graduates are making career choices. In Figure 2.1, self-efficacy is presented as the first step in determining interests.

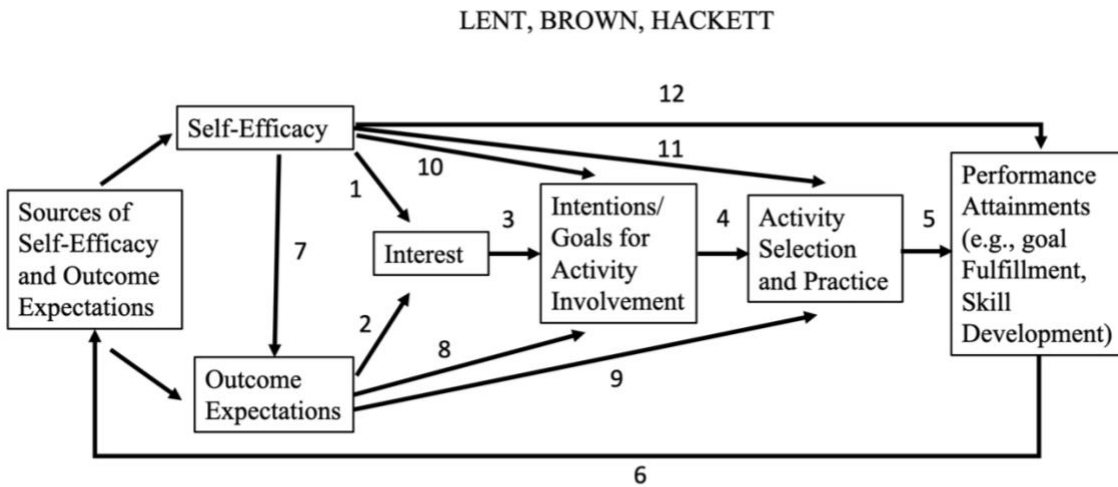


Figure 2.1. Model of How Basic Career Interests Develop Over Time. This Model Highlights Cognitive and Behavioral Influences During Childhood and Adolescence. Copyright 1994 by R.W. Lent, S.D. Brown, and G. Hackett. Reprinted by permission.

Self-efficacy refers to “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986). Betz and Hackett (1981) suggest self-efficacy is predictive of academic and career-related choice and performance. The theoretical model (Lent et al., 1994) orders the stages of how career interests

develop over time because of cognitive and behavioral influences. As a person transitions through childhood and adolescence, behaviors are within parameters set by external influences. In the early stages of life, how one perceives oneself is guided by those external influences, and as maturity occurs, self-efficacy is from within. How one views their abilities (self-efficacy), coupled with outcome expectations of what will come, shapes one's interests and the goals one chooses to pursue as a result. Much of this phase is based on intrinsic motivation and not significantly affected by external factors; however, interests can be related to the childhood environment and influenced by media, experiences, and imposed perspectives. Once interests and goals are identified, activity and practice follow. People choose what activities to participate in based on their interests and if they perceive it will help them achieve their goals. For example, enjoyment or perceived impact could motivate the choice to engage in specific activities and opportunities. Ideally, these experiences will help an individual attain their goals. As goals are attained and new skills are developed, one will have a new view of themselves and their abilities. This becomes a point of renewed self-efficacy and a place where new expected outcomes emerge because of the growth into new skills and abilities. Here, the process can begin again and can happen continuously throughout a person's educational experience and into early adulthood.

Three intricately linked aspects of career development are detailed in the Social Cognitive Theory of Career and Academic Interest, Choice, and Performance (Lent, et al., 1994). These include (a) the formation and elaboration of career-relevant interests, (b) the selection of academic and career choice options, and (c) performance and persistence in educational and occupational pursuits. The framework builds on Social Cognitive Theory at the general level and personal agency combined with other factors that affect the career development process (Bandura, 1986).

Lent and others (1994) made predictions from the theory's analysis through

propositions and subsequent hypotheses:

“Proposition 1: An individual’s occupational or academic interests at any point in time are reflective of his or her concurrent self-efficacy beliefs and outcome expectations” (Lent et al., 1994, p. 91).

“Proposition 2: An individual’s occupational interests also are influenced by his or her occupationally relevant abilities, but this relation is mediated by one’s self-efficacy beliefs” (Lent et al., 1994, p. 92).

“Proposition 3: Self-efficacy beliefs affect choice goals and actions both directly and Indirectly” (Lent et al., 1994, p. 96).

“Proposition 4: Outcome expectations affect choice goals and actions both directly and indirectly” (Lent et al., 1994, p. 97).

“Proposition 5: People will aspire to enter (i.e., develop choice goals for) occupations or academic fields that are consistent with their primary interest areas” (Lent et al., 1994, p. 97).

“Proposition 6: People will attempt to enter occupations or academic fields that are consonant with their choice goals, if they are committed to their goal, and their goal is stated in clear terms, proximal to the point of actual entry” (Lent et al., 1994, p. 97).

“Proposition 7: Interests affect entry behaviors (actions) indirectly through their influence on choice goals” (Lent et al., 1994, p. 98).

This study examined the experiences related to academic preparation that contribute to career performance, the perceived self-efficacy or confidence gained during the educational tenure, the perceived performance during that tenure, and the perceived performance attainment level and subsequent preparedness for industry challenges.

Even though the primary focus of this theoretical model is from childhood through early adolescence, the process occurs for college-age students as well. Their self-efficacy, or confidence to make meaningful decisions that affect performance outcomes, is essential. Furthermore, it applies to the iterative nature of activity selection by repeating the same process each time decisions are made with specific outcomes in mind.

The act of learning, changing, and doing, is continual in the human experience, and educators should strive not only to provide information and prepare students for graduation but also to prepare them for the Vocation of Life (Dewey, 2008). In Dewey's framework, in step one, students are asked to perform a task that represents the "Do" component. As we seek to encourage students to reflect on their actions and experiences, this leads to steps two and three, which engage students in reflections designed to promote the sharing of observations and to process what they experienced. Lastly, steps four and five seek to encourage students to use the "do" and "reflection" components to connect with their previous experiences as well as those real-world examples that this experience can be applied to. When students can apply their hands-on skills to various situations the model comes full circle. This theoretical framework not only examines how specific skills and aptitudes necessary for receiving a degree in higher education can be utilized for career readiness, but it also contributes to skills that result in growth and impact at home and in communities. This framework, shown in Figure 2.2 was considered when developing the research questions and the data interpretation.

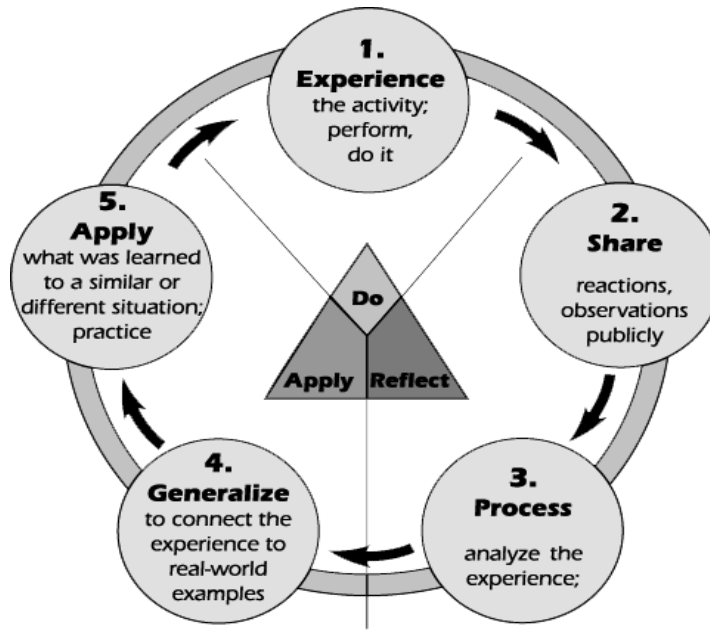


Figure. 2.2 The Pragmatic Approach of Learning Through a Hands-on Approach is Introduced in This Diagram. (pedagogy4change.org/john-dewey/)

Review of Related Research

Degree Deliverables

Curriculum evaluation and reform to measure learning and to keep academic entities accountable for the growth of that learning is an expectation of the industry. Because many incoming college students participate in high school agriculture courses and activities, the CASE curriculum (National Council for Agricultural Education, 2021) was reviewed and compared to two publications: *Competencies for the United States Horticulture Undergraduate Major* (Basinger, et. al., 2009) and *Proposed Learning Outcomes for Four-year Horticulture Programs in the United States* (Pritts, & Park, 2013). Specifically, knowledge, skillsets, and values were examined for introduction, reinforcement, and mastery during a student’s progression through a set curriculum. Learning outcomes and objectives were assessed, and a weakness in written communication was identified. These sources provided the basis to identify commonalities between learning goals in student education and

subsequent skills and abilities transferred to the workforce/plant industries.

Related to this and student learning environments, the Student Experience Project (2021) sought to systematically measure and improve student experience and suggested faculty are essential change agents and that improvements to student experiences not only provide educational equity but also enhance instructor job satisfaction and belonging. Furthermore, overcoming barriers to enrollment at colleges and universities for diverse populations is a focus, and the project seeks to enhance retention and graduation rates through student support and well-being initiatives.

Wolniak (2019) found that specific experiences align with specific career outcomes, and the relationship between high-impact experiences and early career outcomes is complex and varies greatly for each student. This study suggested more understanding of the dynamic relationship between the college experience, the institution type, and the field of study is needed. With the perspectives of these studies in mind, the following categories were identified as key factors predicting career success. Further, Hall (2017) found that 90% of alums valued internships, undergraduate research experiences, formal courses, study abroad, and independent studies.

High-Impact Experiences in Higher Education

Academics

Bampasidou et al. (2016) determined that high-impact learning activities are resource-intensive and require high student effort while developing and honing career skills. Perceptions of critical career skills were examined, and critical thinking, oral communication, and time management were ranked highest in importance. Furthermore, industry-oriented undergraduate clubs and innovative classroom activities were reported to develop those skills most effectively. What needs to be clarified and represented in the study is the alignment of job responsibilities

and academic directives for skill development. Dunn (2013) stated that the impact of first-year student experiences was determined from a student's perspective. Extracurricular participation, interactions with faculty, and educational quality were measured through an electronic survey with open-ended and opinion questions to degree-seeking undergraduates in an agricultural college. A 34% response rate yielded results that included information about student's first year experiences, interactions with faculty, social interaction, belonging, and overall satisfaction with the undergraduate experience. The efforts to retain students were viewed as impactful and favorable, but more individual connection and community were desired. DuPre (2011) sought to understand the gap between employer expectations and student perceptions of on-the-job skills and found there was a lack of desired job skills among applicants. DuPre (2011) went on to conclude that on-campus curriculum and programs for career readiness are necessary.

Esters (2013) conducted an exploratory study measuring the impact of a work-based learning program, Science with Practice (SWP). The study found that the SWP positively affected vocational identity and career decision self-efficacy but did not affect career maturity decisions. The SWP was implemented college-wide, working with staff and faculty in research laboratories, administrative units, farms, greenhouses, and other entities related to academia. The experiences included 10 hours/week with outcomes related to technical skills, research, STEM and upper-level coursework connections, and educational and career exploration. Pre and post-test assessments were utilized with a sample size of 62 participants. Many participants had already made a career decision, but this SWP helped to clarify career decisions.

Internships

Anderson (2015) sought to determine the perceived value of an internship experience by the students and employers. Students reported learning new information and techniques, and the

experience provided an opportunity to explore a potential career due to firsthand knowledge of careers in their area of interest. Baranko (2015) believes internships are a way for graduates to differentiate themselves from others with undergraduate degrees since internships provide valuable real-world experience. Stofer (2021), in agreement with Friesenborg (2002), suggests internships help students contextualize theoretical classroom knowledge into real-world job practices increase self-efficacy, and enhance career goals.

Field Experiences

Feldpausch et al. (2019) examined the changing natures of curricular programming to successfully launch pre-veterinarian students into careers by studying coursework, club participation, relevant work experience, international experience, advising/mentoring, college life, and professional networking. These were identified by students as preparation for career success, with 82% ranking relevant work experience, in this case, on-farm work experiences, as most critical. The study also suggested that universities offer on-campus work experiences as a convenient way to gain experience. In a study conducted by Foreman (2012), it was concluded that students scored higher on two leadership metrics when serving as officers of a club or organization and spending more hours per week in extracurricular clubs and organizations. The parallels of these two studies rest in the fact that student experiences are all unique to their lives and opportunities and many factors go into making decisions during the undergraduate experience.

Travel

Most colleges and universities facilitate and promote study abroad experiences as they provide career and life skill development. VanDerZanden (2013) measured global citizen preparedness through a study-abroad experience, and the result was a perceived gain in preparing

students, maximizing faculty investment, and study abroad effectiveness. Through a Research and Extension Experience for Undergraduates (REEU), Fontanier (2019) determined that agriculture-related fields, especially horticulture, emphasize scientific aspects to reach urban and minority populations otherwise unaware of agriculture-related career opportunities. This hands-on opportunity created by the USDA and Oklahoma State University connected undergraduate students to food and agricultural science and students learned about research methodology, and equipment, and attended professional presentations. This experience included industry interactions and networking and encouraged professional conference attendance.

Undergraduate research

Hall (2017) utilized capstone experiences to measure the impact on learning and career preparation. These included internships, undergraduate research experiences, formal courses, study abroad, and independent studies. Most participants in these types of experiences reported that the experience helped them prepare for their careers. Ninety percent of alumni associated the seven learning objectives with career success. Ortiz (2020) added an undergraduate research experience to a course to improve hands-on experiences in field methods in wildlife science related to bird identification. Through pre and post-tests, eighteen percent improved bird ID skills but no increase in bird ecology interest occurred. Mastronardi (2021) reported there is a positive impact on the promotion of graduate school, pursuit of STEM careers, and a gain in self-reported skills.

Student Success Initiatives/Centers

Building belonging at institutions is a crucial component of student success. Students begin college in vastly different places academically and socially. Some come to school needing more confidence that they will succeed. This is especially true of students who have been

underserved in prior educational experiences (Venit, 2021).

Education for “world readiness” is a 21st-century education that broadens horizons, stimulates curiosity, and involves the discovery of fields of knowledge, ways of knowing, and perspectives well beyond what most students have encountered in high school (The Equity-Excellence Imperative, 2022). A poll conducted by Gallup.com at Purdue University focused on college experiences linked to lifelong success (2019) found six elements of the undergraduate experience had a significant effect on a student’s post-graduation success:

1. A professor who made them excited to learn;
2. A professor who cared about them as individuals;
3. A mentor who pushed students to reach their goals;
4. Working on a long-term project;
5. Completing a job or internship related to classroom lessons;
6. Being engaged in extracurricular activities and groups.

Only 3% of students said they “strongly agree” that they had all six experiences, and among graduates who strongly agree their schools prepared them well for life, 82% reported experiencing all big six, compared with just 5% who say they experienced none. Researchers also found that the six experiences are connected to time-to-completion: 75% of graduates who “strongly agreed” they experienced all six finished their degrees in four years—while that rate fell to just 61% for respondents who reported experiencing none.

Workplace Readiness

Educationally, content retention is one of many instructional goals. When both hard and soft skills are measured in an online format, improvement is possible (Moore & Pearson, 2016). Soft skills such as personality and motivation affect career success while GPA and achievement tests do not always predict career success (Heckman & Kautz, 2012). Workplaces demand that

soft skills coupled with hard skills benefit potential employees (Robles, 2012). When hiring for an entry-level landscape contracting position, candidates with strong horticultural skills are preferred over those with solid business skills (Beidler et al., 2006). Concerning perceptions of preparedness, VanDerZanden & Reinert (2009) followed up with a survey of 107 employers who hired undergraduates of a horticulture degree program and found that 52% of employers ranked graduates as adequately to exceptionally prepared and 42% as adequately prepared. Duncan et al. (2008) studied the workplace readiness of undergraduates in horticulture and found that 76% of first and current jobs related to their degree, and 95% rated themselves as adequately prepared.

Twenty-first-century skills are categorized into four skills: communication, ethics, leadership and followership, and knowledge of contemporary issues and lifelong learning are needed in many professions and when possible, add to career readiness when implemented into college coursework (Strauss, 2020). Employers seek out potential employees often during the mid-point of a student's academic career and desire employees who are good communicators, team contributors, flexible, and independent (Hendrix, 2018). Furthermore, internships are also a great way to connect future employers with current students. It was discovered that capstone courses are helping to prepare students to enter the workplace based on the needs of the industry and are also providing students with skills and opportunities that are being transferred to the workplace and the day-to-day aspects of the agricultural industry (Rinker, 2020).

A Delphi study of 23 agricultural industry experts identified 18 technical skills and 34 professional skills that added high value to graduates. However, more research should be done to determine how those transferred into the workplace (Rinker et al., 2020). Out-of-classroom activities have a positive effect on at least one critical thinking disposition and can bring added value to a student's career readiness. Institutions are encouraged to enhance student learning

opportunities by leveraging student employment, incentivizing faculty-student research, and partnering with local employers (Fleming, 2019).

The role of higher education is to meet the needs of societal stakeholders and draw attention to educational strategies that can empower academic staff to develop and enhance their teaching, learning, and assessment practices. Additionally, it should encourage students to attain the graduate capabilities required and expected by societal stakeholders during undergraduate studies (Metcalf, 2019).

Chapter Summary

Students pursue degrees in horticulture for personal interests, family recommendations, job opportunities, and other reasons. Lent et al. (1994) noted Proposition 7 states “Interests affect entry behaviors (actions) indirectly through their influence on choice goals” (p.98). Based on this theory, interest drives action and activity selection and these experiences lead to skill attainment and the achievement of goals. Once these goals are achieved a person has a new source of self-efficacy, leading to the development of new interests, and the process of growth and self-discovery continues. A college education provides students the opportunity to experience this process throughout their educational tenure and should result in a graduate’s preparedness for the workforce. Horticultural degree programs typically strive to offer academic rigor, student involvement opportunities, and career networking. Many horticultural programs intentionally offer high-impact experiences such as internships, research experiences, and travel opportunities to prepare students for careers. If programs do these things well, students are career-ready, and their interests develop and grow over time.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study was to explore the perception of graduates from the Department of Horticultural Science, focusing on their undergraduate experiences and those factors and opportunities designed to enrich learning, thus providing insight into how those experiences influenced readiness for employment in horticulture. In addition, an exploration into a student's abilities, confidence, past performance, perceived performance, and skill attainment level were taken into consideration when determining which factors and experiences need to be emphasized in similar programs to develop necessary skill sets for successful careers in the horticulture industry.

This chapter explains how this study utilized qualitative research methods to determine the perceptions of recent graduates of the Department of Horticultural Science about career readiness and the experiences they felt prepared them. The qualitative approach chosen was a single instrumental case-study design to frame knowledge and explore potential impacts within a department of horticulture. A case study is an immersive process that requires the researcher to gather information from current happenings and in retrospect (Frey, 2018). It is both a process of inquiry about the case at hand and the product of that inquiry. This method was appropriate because participants were asked to reflect on both their time as students and now as industry professionals.

The following questions guided this study:

1. What are the perceptions of recent graduates of the Department of Horticultural Science at North Carolina State University in reference to their preparedness to enter the horticultural field (RQ1)?

2. What were the perceived major experiences that allowed them to be successful upon entering their careers (RQ2)?

Methodology Highlight

This research utilized a case study format and selected recent graduates of the Department of Horticultural Science at NC State University to determine how they perceived they were prepared for a successful career in horticulture.

The methodology for collecting data included focus groups with ten recently graduated students and individualized follow-up interviews with the same students regarding specific topics related to their experiences that were or were not highlighted during the focus groups. The population of individuals queried were those who received an education at NC State University within the Department of Horticultural Science graduated between 2015 to 2022 and entered the horticultural industry shortly after. The date range reflected course offerings before and during the COVID-19 pandemic of 2020-2022. This group of graduates included graduate students, a small-scale farmer/entrepreneur, landscape design/build professionals, a commercial viticulturist, a private estate gardener, an extension agent, and a botanic garden curator. Berkovich (2018) suggests that positivist qualitative research is a unique method of social science research and recognizing it as a distinct and legitimate type can improve qualitative studies in social science. Therefore, a positivist approach was used to identify the true nature of this transition from academia to professional work.

Reflexivity Statement

From an epistemological point of view, I believe that knowledge is gained by reading, hearing, watching, and doing. This is a very pragmatic approach, and I encourage students to see things the same way. I assume that students often take the most straightforward approach to a challenge and ultimately have the ability and responsibility to make their own decisions. Related

to my research interest, I am curious if this viewpoint is accurate. I suspect my viewpoint may be altered during this process.

Like Lee (2020), where nine subjectivities are included, my worldview is affected by my age as I am in my late forties and have roles as a son, brother, husband, father, American-born white male, neighbor, educator, and leader in my academic field. While these roles are very different in scope, the similarities lie in leadership, responsibility, and the desire to succeed. In my chosen profession as an educator, mentor, and colleague, I see the world filled with tasks and roles that require a great deal of thought, intentionality, and effort.

My post-secondary training is in horticulture, and I have taught in this academic area for 23 years. Therefore, I would be an emic or insider researcher since my experiences are like my students and I know the horticulture industry well. I perceive a community of practice and a similar language of understanding exists between my students and me. Because I also served as several of the participants' former advisors, course instructors, and/or Horticulture Team Advisor, this also hopefully fostered a sense of trust. This helps me to quickly establish rapport and gain information from them by using similar vocabulary and empathizing with challenges related to academia and career settings.

I am aware of the increasing distance between a college student's age and perspective and my own. I hope that will not adversely affect my ability to glean useful information from this research. I will also be working with colleagues in the industry who were once students. This requires a different approach since they have progressed into professional roles and are no longer in apprenticeship or learning environments.

I have a research goal in mind, yet even in my limited experience, I perceive that much will change over time as I learn different approaches to research and new ways to analyze and apply results. I will develop different perspectives due to my age, stage of life, demands on time,

and the changing climate of education. Attrition may take a toll on the data, and reflexive abilities will be tested. Since I now recognize that I bring in preconceptions from personal and professional experiences, I expect to learn new things about my motivations and perspectives related to this area of research interest. Positionality will evolve with progress into research, personal and professional maturity, and interactions with other researchers and participants in qualitative research.

Rationale for Qualitative Study

As stated in the introduction, a basic qualitative approach was utilized for this study. A single instrumental, exploratory case-study design allowed for an immersive process that required the researcher to gather information from current happenings and in retrospect. It is both a process of inquiry about the case at hand and the product of that inquiry (Frey, 2018). Furthermore, the case study approach allowed the selection of participants within clear boundaries and with ease of accessibility. Case studies are conducted by selecting a protocol for data collection, determining a method of analysis that yields meaningful results, and reporting those results clearly (Yin, 2017). Results can be informative to colleagues interested in evaluating teaching pedagogy with findings leading to improved efficacy within a department or college.

The knowledge of the selected participants was appropriate to the overall objectives of this research since they are perceived to have an intrinsic motivation to assist in improving the educational degree programs within the study as they are now industry professionals who hope to maintain high industry standards and would benefit from future graduates' preparedness from the program. In this instance, the former students define the case. The single instrumental case-study design allowed flexibility in selecting participants and the use of direct and open-ended questions.

Research Design

The two research questions guided the formulation of the focus group and individualized interview protocols. These interview questions were developed after conducting literature reviews focused on experiences and career outcomes (Wolniak, 2019) and the relationship between high-impact learning activities and career skill development (Bampasidou et. al., 2016). Further research about specific activities impacting career skills was evaluated and helped further develop questions related to high-impact experiences such as internships (Anderson, 2015), study abroad (VanDerZanden, 2013), capstone experiences (Hall, 2017), field experiences (Feldpausch et al., 2019) and the 10 essential standards.

Based on the theoretical framework designed by Lent et al. (1994), the focus group and individual interview questions sought to explore steps four and five of the frameworks: activity selection and practice, activity selection related to goal attainment, and lastly goal attainment fostering new skill development and their perceived workplace readiness. This returned to an exploration of self-efficacy where they may have a revised view of themselves based on goal attainment and can continue to develop career interests as they progress into early employment. Research question one (RQ1) interview questions explored whether participants perceived their education prepared them for their careers and sought to identify which specific skills and knowledge were needed in their careers. Research question two (RQ2) sought to reveal what the perceived significant experiences were that allowed them to be successful upon entering their careers.

The focus group questions sought to explore demographic information from the participants, undergraduate learning opportunities, specific skills gained, and the resulting preparedness for their chosen careers. The first two questions were aimed at original awareness

of degree programs at NC State University and once engaged as a student, what experiences were perceived as most beneficial. The following three questions explored the relationship between specific undergraduate student experiences and took a retrospective look at how prepared they were once in the workforce. The last three questions sought to explore skill development and relevant course content utilized by professionals in the horticulture industry.

The follow-up individualized interview questions yielded additional demographic information and its relationship to the choice to pursue a horticulture degree from NC State University. Four questions were asked about responsibilities in the participant's particular field, career skills, aptitudes necessary for their view of success, and an actual definition of success in their own words. A few questions revisited course content and compared online versus face-to-face methodology. Lastly, the researcher sought recommendations for courses and experiences to better meet the needs of entering the workforce. The final question asked participants to imagine they were giving advice to a new student and what would the advice entail.

In creating the questionnaires, some questions were intentionally restated to reveal if there were consistencies or inconsistencies between the focus group and individual interview answers. During the focus groups, participants responded to each other and built off other participants' answers. In the individual interviews, answers to intentionally restated questions like those asked during the focus groups revealed significant consistency.

This study included ten participants, and interviews were utilized as the main source of data collection. This study (IRB Protocol 26289) was reviewed by IRB and approved as exempt on August 18, 2023.

Participant Selection

Purposive and criterion sampling was used to select recent graduates of the Department of Horticultural Science Bachelor of Science degree program at NC State University. These

students graduated within two to nine years, had a variety of educational experiences, participated in extracurricular opportunities, and represented various careers within the horticulture industry. The researcher worked with the Department's Administrative Support Specialist, who had first-hand knowledge of these students' characteristics to select participants who met the criteria for this research. The researcher wanted participants from various careers in hopes of adding diverse career perspectives. Participants were also sought based on those who did and did not participate in extracurriculars, internships, competitions, and study tours. Further, participants from different geographical regions were also a primary objective of the selection process. Seventeen alumni were invited to participate, and ten accepted the invitation, seven of whom were women and three men. LinkedIn was used to invite participants to participate in the study. Several of the individuals who responded after the deadline acknowledged they did not use LinkedIn which could explain the lack of response by the other ten. For those that agreed to participate, interview dates and times were set. A consent memo is included in Appendix C.

Pilot Participant

To determine if the focus group and individual interview questions were clear, concise, and appropriate for alumni of Horticultural Science, a pilot study with a pilot participant anonymously identified as *Yucca* was conducted. His love of agriculture developed into career aspirations in high school through hands-on applications in his high school greenhouse and other FFA activities. *Yucca* went to a community college after high school and received his associate degree. He was a recipient of a scholarship that supported his transfer to NC State, allowing him to take advantage of many opportunities available during his time in the department (first plane ride, first time out of the country, and first time spent in a research setting). From there, he utilized his undergraduate experiences to springboard into a Master of

Science program. He then received a position with cooperative extension as a horticulture agent.

After my pilot interview with *Yucca*, the researcher reviewed the transcriptions and then scheduled a conference call with the participants. The interview protocol was edited to reflect the rephrasing of a few questions to improve clarity.

Data Collection

In this exploratory case study research approach, I, as the researcher, had flexibility in data collection methods. The first way of collecting data was by utilizing two focus groups that brought together multiple participants, presented them with the same questions, and provided opportunities for them to discuss between themselves. Gundumogula (2020) stated that online focus groups are an increasingly popular method for an in-depth and structured gathering of information within a small group. With this strategy, I facilitated and allowed the conversation to go in the direction the participants wished to take it. The focus group allowed me to recognize and document body language, comfort versus discomfort, and conversational dynamics within my reflexive journal to assist in triangulating the data. Each focus group lasted an average of 61 minutes, and the transcripts ranged in word count from 8871 words to 9198 with an average of 9034 words per transcript.

The choice to employ this strategy coincides with research stating that in the recent transition to online interactions, participants expect to be online and embrace the interactions, realizing their benefits and limitations (Focus group - Researchdesignreview.com, 2020). The second data collection method was done within two weeks after the focus groups using ten structured individualized interviews via Zoom: again, as a helpful tool familiar to participants (Debenham, 2007). Each follow-up interview lasted an average of 22 minutes, and the transcripts ranged in word count from 1994 words to 4931 with an average of 3107 words per

transcript. Table (1) outlines the methodology and benefits of using this approach.

Table 1: *Approach for Gaining Information from Study Participants.*

Data Collection Method	Main Points (My notes/Important Info)	How would it help my study?
Online, Video-Based Focus Group Interviews	COVID changed the approach to conversations, and many have adapted and become comfortable with electronic conversations (Researchdesignreview.com, 2020)	This would allow others to compare experiences with their educational experiences in real time. More people could participate in an online format than meeting as a group in person.
Synchronous Interviews (in-person or via Zoom)	Working individuals will have to be able to schedule interviews as the nature of their work may change from day to day (Debenham, 2007)	This would allow the participants to answer the same questions at times convenient to them in a setting most comfortable for them at a time of their choosing.

The participants voluntarily gave their time and attention to this project, and Appendix D provides the participant interview protocol. Participants were contacted via email after they agreed to participate. Two Zoom group discussions were scheduled, one late in the day and another during lunch. Since they are all employed, this platform gave them the most flexibility in scheduling and addressed the inability for many of the participants to meet in person due to their locations across the state.

Once everyone entered the Zoom session, the researcher provided a brief overview of Zoom and discussed any potential challenges with the use of this technology. Greetings and an overview of the researcher’s background was shared. Since the researcher had served as an advisor, course instructor, and team competition advisor within the department, previous relationships with some participants were already established and provided a level of trust and rapport. All research questions were placed in the chat feature of zoom allowing each participant

to read the questions as well as hear them. Following the focus group interviews, individual interviews were scheduled and utilized the Zoom software for conducting the interviews.

Data Analysis

The process for data analysis progressed from immersion to reading and rereading, brief notetaking about any observations and analytic ideas or insights, and creating initial notes, codes, and themes. The objective of data analysis was to develop an in-depth description and analysis of a single case and provide an in-depth understanding of that case. According to Braun & Clarke (2006), reflexive thematic analysis is categorized into six phases of approach: the researcher familiarizes themselves with the dataset, codes are developed, initial themes are generated, development of thematic conclusion and review of those is done, conclusions are refined, themes are defined and named, and review of the themes is conducted. This was conducted for this research, and the findings are based on this process. To determine the similarities and consistencies between participants, the coding of this data thematically moved from information through patterns in their conversations and artifacts. Organization of files, with notes and initial codes, transitioned into the description of each case and its context. Themes and patterns were categorized and interpreted directly to determine what was learned. This yielded an in-depth picture of the case using narratives and tables. Primary and secondary coding cycles yielded interesting and frequent theories and generated thematic categories (Saldana, 2016).

While MAXQDA software was helpful as an organizational tool for participant responses, manual coding was the primary method of developing themes. The software was also used as a repository for the transcripts that were easily accessible from an online login. This prevented the need to transport lengthy documents to various data analysis locations.

This product was accessed through a paid subscription service which allowed categorization and content to be arranged by themes. It was chosen because it was economically

reasonable, holds a large sector of the qualitative analysis software market, has good user reviews, is easy to use, and offers convenience for research collaborators. Focus group and individual interview transcripts were loaded into the software, they were coded, and themes were developed. An artificial intelligence feature in MAXQDA was used to summarize the coded segments, and the results agreed with the researcher's transcript reviews and manual coding and identified themes.

Qualitative Quality

The issue of qualitative quality is essential to address in many scientific research communities since qualitative research can be accused of low rigor and limited sample sizes that quantitative research scenarios usually garner. The five criteria introduced for qualitative research quality are credibility, dependability, confirmability, transferability, and authenticity (Guba & Lincoln, 1994).

The research participant was protected from the beginning to the end of the process. From the initial study invitation, the researcher communicated the purpose of the study, potential risks, and perceived benefits. Anonymity was maintained by assigning each participant a pseudonym. At the beginning of each interview, the participant was reminded they were able to withdraw or leave the study at any time. At NC State and other institutions of higher learning, the IRB is the governing body for research participant protection. Qualitative studies are submitted to the IRB for examination and approval. A protective mechanism is the guidance of the Belmont Report which promotes respect, beneficence, and justice for the study participant. This occurred for this study as NC State eIRB #: 26289.

Cypress (2017) states that trustworthiness refers to the quality, authenticity, and truthfulness of the findings of qualitative research. It relates to the degree of trust, or confidence, readers have in results. Yin (1994) describes trustworthiness as a criterion judging the quality of

a research design. Privitera (2017) agrees with Lincoln and Guba's listing of credibility, dependability, confirmability, and transferability as the criteria for trustworthiness, with credibility and transferability paralleling internal and external validity and dependability relating to reliability and confirmability paralleling objectivity. Forero et al. (2018) explain that the purpose of credibility is to establish, from the perspective of the participants, the confidence that the results are believable.

In this study, to ensure trustworthiness, the researcher utilized a pilot participant to qualify the questions, and he made slight edits to provide clarity for future study participants. Member checking included returning the transcripts to the participants, allowing them to edit for accuracy, and ensuring responses reflected the participant's original intentions. Dependability's purpose is to ensure the findings would occur within the same context and cohort of participants if an inquiry were repeated. This was accomplished using inter-coders and, in this case, two graduate committee members were asked to examine the data through a process known as peer reviewing. Triangulation of data aims to measure the variance within the phenomena and not the method. The result of this effort is whether there is convergence, inconsistency, and contradiction. Confirmability includes triangulation techniques, and the use of multiple data sources which included focus groups and individualized in-depth interviews was used in this study (Carter, et. al, 2014). Transferability was accomplished through identifying the criteria for purposive sampling. Data saturation was also achieved, in that enough data was collected to draw necessary conclusions, thus allowing results to be transferred to other contexts or settings. In addition, various theories were considered for comparison to the data. In a recently reviewed dissertation, Strauss (2020) utilized triangulation and a pilot study to increase the qualitative credibility of the study, and the researcher's process paralleled Strauss' recommendations.

Chapter Summary

This chapter presented the techniques and methodology used in the study to explore skills and aptitudes gained by graduates of the Department of Horticultural Science at NC State University. A qualitative case-study design was used. Ten alumni participated in two focus groups and individual follow-up interviews to create the primary sources of data. Themes were determined from the transcription and coding of the data.

CHAPTER 4

RESULTS

Participant Descriptions

Ten participants were purposely selected for this study, and each was given pseudonyms to protect their anonymity by IRB protocol. Each participant is a graduate of the Department of Horticultural Science and is described by the demographic information they shared during the interviews. A brief description of each participant and selected interview remarks is included below with letters and numbers referencing the location of the quotation in the original interview transcript and which interview questions the quote was in response to.

As seen in the theoretical model, Lent et al. (1994) suggested childhood influences and experiences shape career interest and skill development. Considering this theory, detailed information from interview transcripts is included about each participant's background and what influences led them to choose a career in horticulture.

Acer

Acer has been an alumnus for eight years and has had various work experiences throughout her academic and early professional career. She attended a magnet high school, a new model in her rural area. She was not given the chance to choose her course electives, and her initial direction was computer engineering. She was told that higher incomes were related to computers. Upon graduation with computer certifications, she realized that she loved plants and quickly learned there were majors that involved plants and a practical application. Her grandfather influenced her decision to pursue horticulture. She is employed by Cooperative Extension and enjoys the investigative side of her position as well as interacting with stakeholders in her county.

Berberis

Berberis grew up on a small cattle farm, and her father was an extension agent. As a child, she was interested in horticulture, experienced animal production, and participated in 4-H and FFA. Her family raised a large garden, and she recalls picking up rocks, harvesting produce, and planting. Her academic interest was not initially in plants and her original degree pursuit was in animals. She graduated five years ago and married a fellow agricultural graduate. They now run a family farming business and want to pass on its importance to the next generation and ensure the farm is an option for any future children.

Caladium

Caladium also graduated five years ago. He was active in FFA and only wanted to attend NC State University to study horticulture. After graduation, he worked as a municipal gardener and a university gardener and now manages a private estate. His undergraduate experience included internships, the Student Competition Team, and the Horticulture Club.

Dianthus

Dianthus had no previous agricultural experience and was excited and interested in an environmental science class in high school. She began her academic career at another university since she was not initially accepted into NC State. She later graduated from NC State in 2019. The transfer was mainly due to her familiarity with it since her father and oldest sister are alumni. She is now a graduate student at another university focusing on plant research. Her initial interest and subsequent success were attributed to a specific faculty member within the Department of Horticultural Science who offered undergraduate research experiences.

Fothergilla

Fothergilla grew up with parents involved in landscaping and has always been passionate about the environment. Her initial career pursuit was to be a dental hygienist until someone asked if she had a passion for cleaning teeth. To that question, she answered, “No.” She inadvertently became interested in vertical gardening and began her academic career in the

community college system. She is an NC State University alumna of 4 years and now works as a public garden curator focusing on environmental protection and management. She was a member of the Horticulture Club.

Miscanthus

Miscanthus was a pre-med major until discovering horticultural science through a chance meeting with a faculty member in the horticultural building on NC State's campus. Her first few years were challenging academically, but stated that once she chose horticulture, she found her own campus community. She graduated in 2019 and now works for a company that designs and manages commercial landscapes.

Narcissus

Narcissus brought previous agricultural experience with cattle, tobacco, and nursery plant production into his undergraduate degree. He began an academic pursuit in Agricultural Education but found more value in horticultural courses. Once he discovered the degree option, he switched to Horticultural Science. He works at a Research Station and is a 3-year alum. As an undergraduate student, he had a wide variety of work experiences in horticulture that he applies today in his career at the research Station.

Quercus

Quercus did not have an agricultural background, and so she began her career at the Agricultural Institute (Associate of Applied Science degree) and then matriculated into the BS (Bachelor of Science) degree program. She is a 2021 graduate and a landscape designer with a regional commercial landscape company. Within her career field she noted that it is male dominated. *Quercus* discussed she pursues overall happiness with the people she works with and uses her creativity, which leads to a sense of pride in addition to making money.

Trillium

Trillium is a 2022 graduate and is a viticulturist for a winemaker. As a child, she had very

little exposure to agriculture and her major influence was a high school agriculture instructor. While at NC State, she was highly involved in the Horticulture Club and Student Competition Team. In her career, she likes learning new things daily and knowing that what she does makes a difference. For her, this creates a sense of pride.

Viburnum

Viburnum is a third-generation agriculturalist who participated in FFA in high school. This led him to pursue being a high school agriculture teacher, but he recognized the stark difference between being a student and a teacher. He took an introductory course in Horticultural Science and was sold on the undergraduate major. He said the best decision he has made was to switch his major. He is a 2022 graduate interested in plant production and is scheduled to finish his MS (Master of Science) degree soon.

By reviewing each participant's reflection on their background, the experiences and influences that led them to pursue a degree in horticulture, and their current career success, everyone is unique. This information sets the foundation on which their undergraduate educational experiences were built. Some had previous agricultural experience and post-secondary educational experiences, while others did not. Each participant had varied self-efficacy and outcome expectations (Lent et al., 1994). Participants came from various backgrounds, and each had a different perception of how they might perform in the degree program.

Research Question 1 (RQ1): What are the perceptions of recent graduates of the Department of Horticultural Science at North Carolina State University in reference to their preparedness to enter the horticultural field?

The two themes that emerged from answers to RQ1 are:

- Preparation for success

- Repeat customer mentality.

Theme 1: Preparation for Success

Because alums had graduated multiple years earlier, participant reflection was needed to examine current capabilities about their academic experiences. Career preparation as an undergraduate is often unrealized, but retrospect provides a clearer picture of value. Participants were able to address that in the following statements.

When asked about anything she wanted to add about the impact of her time at NC State and preparation for her success, *Berberis* emphasized the role of internships and how the vast and varied summer internship experiences prepared her to return to the farm. *Berberis* stated,

“So, everything from working on the farm, learning how to interact, talk, work with Hispanic people, which I had never done before, coming from a very small agricultural background and then also learning how to market, do roadside stands, just a lot of the things that like you just can't learn unless you go do it, learning how they did their packaging, processing, sanitation, just all the things where when you get into it, it's so much more helpful than just learning about it.” (LE-FG1:96)

In similar detail, *Dianthus* discussed the role of a horticultural honors society in the Department of Horticultural Science and how her participation in its annual plant sale had an impact. She reflected,

“I was really involved in an honors society and with the plant sales and with growing vegetables for the plant sales. So yeah, I got a lot of experience with creativity and independence and had a big impact.” (LE-FG1:94)

Caladium agreed with *Dianthus* about feeling prepared for his current roles and credited specific coursework that had an impact. He stated,

“One more course that I feel was instrumental for me, was the green infrastructure class that I took with Anne Spafford. It was very instrumental in changing the way I looked at horticulture and kind of decisions that I make and have made in all my roles, just kind of in a general sense of doing things differently than they may have been done in the past that are for the better now.” (IT-FG2:119-120)

He also specifically credits preparation for his career to his participation on the

landscape competition team, “The landscape competition team also just was an experience that I feel like it prepared me for a professional career in Horticulture.” (LE-FG1:92-93)

Acer talks about the impact of her undergraduate experience and the interactive professors and hands-on experiences that contributed to her feeling prepared for her career. She stated,

“I feel like having gone to NC State, it opened a lot more doors for me as an intern. To enter in different places. But also, the labs when Bryce Lane and Denny Werner were professors and working with the two of them and then just kind of the department as it was just again, shows how hands-on the professors were with their labs. I think just those lab portions were really, helpful just interacting with the professor.” (LE-FG2:69-70)

When asked what learning experiences were most effective at preparing her for professional roles, *Miscanthus* talks about design classes and their well-rounded nature. She stated,

“I think just in the landscape design studios that we would take with Anne and Julie, I think the projects that they selected were good opportunities for us to engage with an actual client, where we would have a design put together. And then in some cases, specifically in Julie's 401 studio, we would build something. So, I think it gave a well-rounded kind of experience to the design process.” (LE-FG1: 88)

When asked the same question *Fothergilla* attributed an internship work experience with a greenhouse curator. She perceived this experience as most effective in preparing her for her professional role. She stated,

“For me, it was the internship I had in the greenhouses with Diane, and I had two summer internships in 2018 and 2019 that were also incredibly beneficial. And then I was also very active in the Horticulture Club as well. And so, I think that a combination of all those experiences helped build my resume and make me a more competitive candidate after graduating.” (LE-FG1:90)

Quercus had lab experiences where she gained hands-on landscape construction skills. She notes this experience as impactful in preparing her for career success and stated,

“So, in terms of really impactful and then, I was going to say working at the Horticulture Field Laboratory (HFL) in Landscape Maintenance and Construction lab experiences many times were rough sometimes in the summertime, but it helped a lot because now I understand better the other side of design, which is actually building and putting things

together and that makes me better at estimating stuff.” (LE-FG2:73)

For this theme, all participants concluded they were prepared by their experiences to be successful in their early careers. Graduates remarked and, in some cases, were surprised at how prepared they were for careers in horticulture. They were satisfied with their overall knowledge of the science of horticulture and their ability to progress into the early stages of their career.

Theme 2: Repeat Customer Mentality

During the focus groups and follow-up interviews, participants were asked to estimate the value related to their choice of an undergraduate institution. Comments were not related to personal cost or sacrifice but directly related to their educational experience’s value.

When asked about anything they want to add about the impact of her time at NC State and its preparation for her success, *Dianthus* compared her experience to other institutions and said she would always choose NC State. She stated,

“I think after getting to see some horticulture, plant science, even colleges of agriculture at other institutions, if I could go back and choose with a clean slate, I would always go back to NC State. That would be the program that I would choose, knowing what I know now about other institutions.” (IT-FG1:114)

From the same question, *Berberis* commented on the perceived value and prestige of a degree from NC State University. She answered,

“So, it's something that I feel like I'm always going to have in common with someone in the group, you know, like whenever meeting other agriculturalists, for instance, other farmers, other people. And it's nice to have commonalities whenever you're getting to know people, but also it is a little prestigious, you know, to be like, oh yeah, I did get a degree from NC State versus, I don't know, other places where I feel like agricultural courses just aren't as good.” (IT-FG1:115)

She continued,

“The quality of the faculty is unmatched. Everyone is so down to earth. I love that pretty much all the professors, we were on a first-name basis with them, and it makes a really big difference, like kind of how you relate to them, and they were always so generous with their time and with their knowledge.” (IT-FG1:117)

Answering the same question regarding the impact of her time at NC State, *Trillium* expressed satisfaction with the choices provided by the degree program and the opportunity for industry connections. She agreed with *Berberis* when she stated,

“I think horticulture is such a great degree in general, but specifically at NC State, there were so many ways you could take it, and there were so many options that you have. So many people that you meet that are connected to the industry. So, I think the same as *Berberis*, I would always choose NC State.” (IT-FG1:116)

All participants expressed the value of their education and when compared to other institutions and/or friends’ educational experiences, leading them to elaborate on choosing an educational experience, and they would choose NC State again.

The following table (Table 2) categorizes the myriad skills gained by alums, thus supporting the results of RQ1 that students did perceive they were prepared to enter the horticultural field with the necessary knowledge and skills and supports/reflects the ten essential standards previously detailed in this study.

Table 2: Skills Gained by Alumni of the Department of Horticultural Science at NC State

University Between 2015 - 2022. Numbers in parentheses represent the number of times these skills were mentioned by students. (SG-FG1&2:71-112)

Technical Skills	Soft/Human Skills	Personal Growth Skills	Horticulture Language Skills	Professional Development Skills
Plant identification (2)	Communication (6)	Meeting new people (1)	Learning the language of horticulture (3)	Developing skills for a future career (10)
Plant propagation (11)	Time management (1)	Making connections (6)	Speaking the same language as others in the profession (2)	Learning from experienced professionals (12)
Plant care (3)	Project management (2)	Trusting creativity (1)	Defining technical terms for non-experts (2)	Applying classroom knowledge to real-world situations (1)
Soil fertility (5) and plant nutrition (7)	Problem-solving (2)	Passion for learning (6)	Making connections with professors and staff (2)	Developing skills for internships and job opportunities (6)
Diagnosis of plant issues (2)	Community engagement (5)	Becoming resourceful (1)	Networking with professionals in the field (3)	Making contacts for future job opportunities (5)
Project management (2)	General people skills (1) and relationship building (2)	Dealing with people from different backgrounds (1)	Communication and public speaking (1)	Developing skills for running a business (3)
	Independence (4)	Developing people skills (1)	Networking (2)	Stakeholder engagement (6)
	Creativity (4)	Thinking creatively (2)		

In both the focus groups and individual interviews, students did, in fact, perceive they were prepared to enter the horticultural field with the necessary knowledge and skills because of

their undergraduate educational experiences in the Department of Horticultural Science at NC State University. They remarked how valuable and impactful their experience was and how the connections they made were crucial to their current successes.

Research Question 2: What were the perceived major experiences that allowed them to be successful upon entering their careers?

The resulting four themes emerged to address research question number two:

- 1: Academic engagement and training
 - a. Rigor and breadth of lecture and laboratory instruction
 - b. Undergraduate research
 - c. Internships and other work experiences
 - d. Hands-on learning
 - e. Face-to-face instruction
- 2: Student engagement and opportunities
 - a. Travel
 - b. Clubs and teams
3. Faculty engagement and industry relationships
 - a. Learning Environment
 - b. Networking and employment opportunities
4. Professional skill set development
 - a. Technical skills
 - b. Soft skills
 - c. Personal growth
 - d. Communication

Theme 1. Academic Engagement and Training

As participants reflected on the experiences in their undergraduate experience that led them to feel prepared for a career in horticulture, one of the themes that emerged from their responses was the role and value of Academic Engagement and Training. Under this theme, the specific experiences they attributed to feeling prepared fell into the following sub-themes: Rigor

and Breadth of Lecture and Laboratory Instruction, Undergraduate Research, Internships and Work Experience, Hands-on Learning, and Face-to-Face Instruction.

Rigor and Breadth of Lecture and Laboratory Instruction

Overall, all ten participants perceived that the broad scope of courses and the richness of their content prepared them for career success. They felt much of the curriculum was deep enough into science while remaining practical in application. The courses were in a reasonable sequence and offered options based on individual interests and needs. Some students remarked that course rigor at other institutions is not as intense.

Quercus had little to no experience with agriculture and chose NC State because of a friend's influence. She found horticulture and learned about it through her degree from the Agricultural Institute. She then matriculated to the Bachelor of Science degree. The rigor and breadth of her academic tenure provided confidence and capabilities in her current professional position where clients trust her ability to select the appropriate plants for their landscape installation projects. Her training in classes like plant identification and landscape construction prepared her for her current role as a landscape designer.

She stated,

“To know that I'm picking plants and of course with only 3 years of working.” (EE-FG2:34)

Fothergilla's position is with a botanical garden, and she focuses on species preservation. She is part of a larger team and contributes through her understanding of introductory horticulture and interpersonal skills learned at NC State University. On the topic of educational experiences related to conservation, she was able to supplement her horticulture courses with courses from other departments. That added to the rigor and breadth of her education thus preparing her for career success. She stated,

“My educational experience was good for horticulture. I really enjoyed all my classes and

everything, but I did need to look at other courses or experiences outside of horticulture because I kind of switched what career I wanted to go towards. So, after taking an internship with a landscape company that did work with vertical gardening, I decided to go into conservation. And so, I kind of tailored the rest of my time at NC State to try and get more experience in that world.” (EE-FG1:32)

Miscanthus works as a landscape designer and oversees the installation of her designs.

Because she is included in the actual fieldwork portion of the process, her designs reflect a practical understanding of how plants exist within landscapes. In relation to educational experiences that prepared her for this role, she stated,

“I think just in the studios that we would take with Anne and Julie, I think the projects that they selected were good opportunities for us to engage with, like an actual client, we would have a design put together. And then in some cases, specifically in Julie's 401 studio, we would build something. So, I think it gave a well-rounded kind of experience to the design process.” (EE-FG1:88)

When *Dianthus* finished her undergraduate experience, she moved directly into a position as a graduate student, where she frequently relies on the rigor of her undergraduate academic coursework. When asked about responsibilities within her current position, she stated,

“I am in the plant pathology and plant microbiology, so I work in vegetables, fungal diseases, and it's an integration of applied and basic research. So, I have field studies where you know everything from sowing seed transplant fertility and field maintenance like applications of fungicides, insecticides and harvesting for my spring to fall responsibility. And then I have a lot of lab work associated with the different diseases that I work on. I also mentor some high school students who work in our lab and then in the summer, some undergraduate students. And so, I've played a role in mentoring them. I'm also doing extension talks and master gardener training. So, there is variety and outreach.” (RS-II:9)

As a requirement for the major, students are required to take discipline-specific classes such as but not limited to plant propagation, plant identification, soil science, and an introductory horticulture course. Related to that requirement, *Miscanthus* liked the variety, depth, and breadth of classes. She stated,

“I think just the variety, like the depth and breadth of courses that we had, each one just built upon the other and was more exciting.” (FE-FG1:20)

Caladium's second professional position was with a private university. He managed established landscape plantings as well as new installations. Regarding educational experience, he felt his undergraduate program was well-rounded and broad. He stated,

“I've been so surprised at how well-rounded I feel like I was after graduating from the Horticulture Department, how broad all the knowledge has been that I've had. I worked for another university for several years and being kind of involved in another institution of higher learning and comparing notes and seeing the outcomes that I was seeing because I had interns at where I was at and just seeing how well rounded I felt that I was after graduating and how much I enjoyed my time and how much I learned and just being so proud of the degree itself compared to a lot of my other colleagues and friends that went to other places.” (EE-FG1:40)

Undergraduate Research

Thirty percent of participants identified undergraduate research as an essential catalyst for decisions in scientific studies related to horticulture. Furthermore, they realized that specific faculty members offered unique and beneficial laboratory experiences.

Dianthus is a very inquisitive individual, and undergraduate research experiences appealed to her. She identified a passion for that research within a plant breeding program. Her childhood experiences with horticulture led her to this interest. While at NC State, she perceived gaining confidence and independence through an undergraduate research experience. *Dianthus* stated,

“I think there are experiences that come to mind that I think were instrumental in developing my confidence and sense of independence. I did an undergrad research experience with Johnathan Schultheis and got to go to a conference and present, which was a steep learning curve, but informative.” (EE-FG1:94)

When asked to give advice to an incoming student *Fothergilla* was remorseful about not participating in undergraduate research. She reflected,

“Something that I didn't even really know existed until it was kind of too late, was undergraduate research. I do think that finding undergraduate research could be super valuable, especially if you're looking to go to graduate school, or, you know, doing some sort of research-based experience. Just undergraduate research. I know *Dianthus* did it, and I always thought that was super interesting. She presented at one point to our class. I thought that was cool.” (AD-II:32)

Internships and Other Work Experiences

Eight of 10 students reported the tremendous value of an internship or internships. These work experiences built upon classroom instruction and guided students to take the next meaningful steps in their academic careers. The choices were not limited to local areas rather, they were presented with many opportunities to choose from. *Viburnum* reflected on how internships helped him make connections and find a job. He stated,

“Whenever I worked internships, I knew how to talk to the people I worked with and made connections. Now I still have those contacts for when I'm looking for a job I can be like, hey, have you heard of any openings or anything?” (SS-FG1:108)

He went on to praise the internship requirements for graduation and perceived them to be the most valuable learning experience since he could apply what was learned in the classroom to a work setting. He reflected,

“Yeah, I absolutely love that the whole program requires you to do an internship before you graduate because, there's no better experience than having work experience. So, I did 2 during my undergrad and those were huge in like, okay, this is what I can expect when I enter the workforce, this is kind of the work environment, what kind of skills they want you to have, type of projects you can expect to work on. So, I would say having internships over the summer were the most valuable learning experiences. And it gave me a chance to apply what I learned in the classroom into the actual work setting.” (LE-FG2:67)

When *Trillium* was asked about valuable experiences, she discussed her internship and how it was the first time she learned to work on a team. She stated,

“I learned that I didn't want to do work in public gardens, but it was my first big, bigger career step. During this internship, it was the first time really working on a team of people instead of doing individual jobs. So, I think even things like learning and interpersonal relationships all contribute to my success today.” (VE-II:20)

Miscanthus also reflected on a work experience and how it provided a new perspective on the profession and why internships are valuable. She stated,

“The work experience gave me an opportunity to see what aspects of the profession I enjoyed and what things I probably wanted to avoid. So, I think internships are a crucial opportunity just to dip your toes in that world.” (VE-II:12)

Caladium emphatically expressed the value of an internship and wished he had done

more. He stated,

“I should have done internships every summer. I will say that if there was a way to require more internships, I would be all for it. I know one internship is required, but if you could do one every summer, I would totally recommend that, especially for someone who doesn't know the direction they want to go with horticulture, because there's a million different ways to go. I mean anything from research to public horticulture, private horticulture, which was not really in my plan.” (VE-II:20)

Narcissus benefitted from an internship which led to his current job. He stated,

“I was fortunate enough to have an internship where I'm working currently so that was big. Plus, I knew what they expected. I knew what the job was before I even totally started.” (LE-FG2:71)

Quercus saw the value in internships because they helped her determine what she did not want to do in the industry. She stated,

“Yeah, so I'll say internships, but I'll say the opposite from others about my first internship. I thought I wanted to do a greenhouse. I thought I wanted to be in research. I mean, that's what I was doing, teeny, little pine seedlings for a whole summer and I think I counted eventually how many I did. It was like over 5,000. So, it was good to have that experience to know that's not the direction that I want to go in. So, that's a learning experience. It's negative, but it's positive in the end. Shift and change and find design and I wanted to design in my next internship with the company that I work for now.” (LE-FG2:73)

Berberis believes in doing more than one internship and advises incoming students to do the same. He stated,

“Doing the internship is important, even if you do more than one. I did more than one. I would do as many internships as possible, and I would tell them not to accept unpaid work.” (AD-II:27)

Regarding learning/work experiences, *Dianthus* had the opportunity to work as an undergraduate teaching assistant. Through this, she gained confidence. She stated,

“So, I was an undergraduate teaching assistant and that was a lovely experience, and it was a course that I had taken this semester prior. It was information I was excited about but also was fresh in my memory, and it felt like an achievement early on in my time. Someone had recognized in me that I did well in the course, and then I had the opportunity to pay it forward.” (VE-II:30)

Hands-on Learning

Eighty percent of students remarked that hands-on training and experience were instrumental in their career preparation, especially for courses like plant identification, plant propagation, and plant pathology. The current model of instruction in the Department of Horticultural Science is of lecture and laboratory learning experiences. Each course builds from foundational information to mastery of subject matter, and with that intentional course sequencing, the science and theory of these courses are reinforced in the greenhouse, laboratory, and field environments. Another benefit students mentioned was the confidence and independence from working alongside faculty in these courses.

Two questions were asked of the participants that directly related to the specific skills and aptitudes they felt prepared them for a career in horticulture. These two are related to research question one, though they also answer RQ2 as hands-on training is an experience included in their undergraduate experience. The first question, “What specific skills gained from your education are you using in your professional career?” was asked in the focus group sessions. The second, “What horticultural skills and aptitudes are most important to you in your career?” was asked in the individual interview sessions.

Comments related to the theme of hands-on training and specific skills follow. These quotes are taken from both the focus groups and individual interviews.

Viburnum is a graduate student studying horticulture and working in a research lab. He had experiences with horticulture as a kid and immersed himself in many student involvement opportunities as an undergraduate. He pursued a graduate degree and continued to engage in experiences that enhanced his education.

When asked about his educational experience in the Department of Horticultural Science he credited hands-on experiences in many classes as the reason why he has had success in his

current position,

“But I will say that, for the research projects I've done, I'm the one person in my research lab that has a lot of greenhouse experience and growing plants. So, we did a fertilizer project with a company this summer and I was the only person in the lab that was even considered to take the project head on because I was one with the most experience. So, obviously my undergraduate classes really prepared me for that. With greenhouse management, nursery, plant prop, all these are different hands-on experiences that have really prepared me for, even the internships I've done over the summers and stuff, like all those classes have been instrumental in helping me prepare for those.” (EE-FG2:28)

Trillium became excited about horticulture during high school. Her teacher was very animated and enthusiastic, and that passion was contagious. She was also very involved in student activities as an undergraduate and made many friends through those experiences.

Trillium spoke about how courses that included hands-on experiences were instrumental to career preparation and stated,

“Plant nutrition is a big part of my job. I remember learning about petiole sampling in that class (plant nutrition) and I thought that that seemed like something that was really like large scale agriculture, and I wouldn't use it, but we do. I alone do 1400 acres of petiole sampling and analyzing those.” (CI-FG1:58)

Berberis came from an agricultural background and enhanced her love of agriculture during her academic tenure. She double majored in horticulture and business studies and pursued internships that helped her decide her ultimate career choice of entrepreneurship. On the topic of courses and hands-on experiences instrumental to career preparation, she specified plant propagation and plant pathology as specific courses that gave her the technical skills to succeed in her current job. She stated,

“My number one class that helped me most in my current job was plant propagation. I propagate a lot of plants from cuttings, and I start a lot of seeds. And the basic principles I use literally all the time. And then the second one for me was plant pathology because it's the same thing throughout the season as the strawberries and flowers start to get disease, identifying that and then what I need to put to help resolve.” (CI-FG1:60)

Caladium was very involved in high school horticulture and FFA. He participated in student organizations as an undergraduate, and his first job was as a municipal horticulturist.

Caladium names ornamental plant ID, plant propagation, and plant pathology as instrumental courses with hands-on experiences that he has used in job roles since graduating. He said,

“Ornamental plant ID, plant propagation and plant pathology are three that I've fallen back on a lot in all the different roles I've had since graduating, but there are a bunch of others. For all three of those, just the knowledge that I learned in those classes, like with plant ID, the knowledge, nomenclature, and taxonomy, I used a lot when I was working in a public garden. And then plant pathology, I've used that knowledge extensively as well.” (CI-FG1:50)

Fothergilla had horticultural influence from her parents, and after learning of poor pesticide disposal practices from a private landscaping company, chose to pursue environmental protection education as a career and added to the conversation about courses instrumental to career preparation. She stated,

“In regard to conservation, I'd say ecology was a very instrumental course that I took in helping me kind of look at conservation and plants through a conservation lens and how plants relate to the natural environment and appreciating what they do in those environments.” (CI-FG1:62)

Face-to-Face Instruction

This theme emerged as all participants described and explained how student experiences with face-to-face instruction provided them with benefits. Five of the 10 participants had no choice during COVID and learned to manage the different expectations of online learning and less hands-on lab work and stated that topics like business, economics, and even writing could remain effective through online instruction, but tactile courses needed hands-on components, and this was valued through in person instruction if possible.

Dianthus elaborated on her personal perceptions of the benefits of face-to-face instruction by remarking,

“I guess the idea I had in avoiding taking online classes was that I would lose the ability to have sort of the spontaneous, informal question and response, or even conversation with professors, and that I tend to have a much easier time remembering material when I can picture where the person was standing, when they were telling me, or where they were pointing on the slide, and that was part of the reason why I avoided the online classes.” (EA-FG1:76)

When asked about face-to-face or online experiences, she goes on to say,

“Most of what I do on a day-to-day basis is field and lab skills that I can't really imagine how they would be taught online. It's hard to think of those skills being effectively taught without getting to hold the tools that you need for data analysis. And most of the statistics classes I've taken have been virtual and that I think has worked well for me a lot of the bioinformatics that I do. I've learned through online modules.” (FF-II:36)

Miscanthus recalls taking plant identification in a face-to-face setting stating,

“In Plant ID, there are some plants that I remember specifically because of where we were standing when Brian Jackson was talking about them. So, there are a lot of things that you can't get in an online setting that you can only get in an in-person setting, like the informal banter and that kind of thing. And I think given the nature of horticulture, a lot of it is hands-on, and it's hard to accomplish that in an online setting.” (EA-FG1:80)

She also took a design course where collaboration was instrumental in the learning process but felt other classes could be taken online. She stated,

“The design process is collaborative and while I think we've compensated and been able to find avenues for collaboration, digitally, it's not the same. You know, it's easy to probably record yourself and your computer screen, like doing a bunch of drafting commands and stuff, and that would probably be useful if it was recorded online. If you missed a command, you could rewind and kind of follow the process again but in terms of exclusively design or plant ID, or that kind of thing where it's better to learn the plan out in the landscape.” (FF-II:20)

Berberis saw value in being physically present with classmates and the instructor. She stated,

“So, remembering who was in the class, all the different components, where the teacher was, what they were saying, all the other conversation that went into it and asking questions, that was really important for me.” (EE-FG1:82)

Fothergilla added to the educational delivery and face-to-face or online instruction discussion and stated,

“I do think that the lab portions would be very helpful to have, in-person. I think that the Plant Pathology Lab one was as successful as it was for me because it was so interactive, and it's set up very well.” (EE-FG1:84)

She continues to explain the intricacies of specific horticultural training and how

beneficial the aspect of hands-on skills is in her job. She stated,

“I think that doing anything hands-on with plant material is super helpful. So, I really didn't understand maternal line tracking until I did it in person several times with a mentor. And so I think that basic concepts coming across in an online setting is one thing but I do think that having that hands-on skill is very important, because, some of the things that I did in some of my past jobs, like seed collecting, taking herbarium specimens, and cleaning seeds and being able to use a dichotomous key, are all things that I feel like I didn't have confidence in until I did it a couple of times in-person. It was just like an online concept without having done it myself.” (FF-II:30)

Trillium experienced some major coursework during COVID and had to take some of those classes online. Despite the convenience offered, she noted the need for interactivity in an online setting. She added,

“The level that I enjoyed the online classes really depended on how interactive they were. For something like the world of horticulture, and I remember post-harvest physiology were both prerecorded, you could go through and watch all the lectures. I hardly had any interactions with the professor so it didn't feel the same as a regular class where I don't know if they do classes like this now, and this might have been a COVID thing, but I remember taking plant nutrition and whole plant physiology online, where for whole plant physiology, it was hybrid, so you could decide whether you want to come in or not, and the professor was lecturing, and the TAs were monitoring the Zoom.” (EA-FG1:86)

Viburnum agreed that face-to-face delivery was preferential and provided information about specific courses. He said,

“*Quercus* mentioned she had plant propagation online. I could not imagine taking that class online because the labs are so hands-on and you miss so many steps with the ideal environment for the plants whenever you're doing all this stuff and how to prepare them, where they're sourced from, and how to do all these technical skills. If online class is strictly content, you can memorize it temporarily to do well in an exam, but physically doing the process you're learning about helps retain those skills.” (EA-FG2:59)

He went on to talk about the social aspect of face-to-face learning and the benefits to making connections to the industry,

“So, you need that social aspect, just learn to interact with people and meet people in the industry. Connections are everything and very important. Also, if you're working in the plant industry, you need to be able to grow a plant. I feel like that's something that can't really be taught efficiently and learned efficiently completely online. Unless you have literally the whole greenhouse setup at home, and then you get perfect, step by step tutorials. I took a plant nutrition class online and I don't feel like anything was sacrificed

there for being online because you just do calculations. Whenever this plant is having this deficiency or anything like that, you know. So those courses are applicable online and just as efficiently learned.” (FF-II:23)

Acer believes the practical nature of horticulture demands face-to-face training so hands-on skills can be developed. He stated,

“I think a lot of things like introductory stuff, I guess you could do it online. But horticulture is so practical, and you know you can show some beautiful pictures all day long and tell stories but until you know you're looking at a tree and having to assess which branch you're going to take out or looking at a group of perennials and figuring out which one you're going to head in, and which one you're going to cut back. I find that with outreach, with public education here in extension, people want hands-on experience.” (FF-II:21)

Berberis believes in-person instruction is essential given the tactile nature of some tasks.

He stated,

“I think I really think everything should be face to face when it comes to horticulture. But that's just because I have a really hard time learning online. Learning how to drive equipment and the greenhouse would have to be face to face. I don't see how that could be useful for virtually any of the businesses.” (AD-II:23)

He goes on to identify some courses he thinks could be successful online by saying,

“The economics and basic business principles, all of those could be taught online. I did take more online classes through act business, anyway. Accounting should be in person.” (FF-II:25)

Caladium uses skills in his current job that he does not think could have been learned in an online environment. He stated,

“In my career I need every hands-on horticulture related skill that you can think of from planting to the use of equipment. But if you can think of a hands-on horticulture skill, I'm using it in my career, and I couldn't have learned them in an online class. There are a few classes I took that may have been hybrid that I may have benefited from. But I was not a very good online student.” (FF-II:28)

Narcissus summarized her position about educational attainment through face-to-face or online learning and stated,

“I think your pathology stuff works well online. I took it online myself. And I learned a lot as I was listening and traveling up and down the road, back and forth to Raleigh. But I

think the biggest thing is, there's certain things like, you know it's hard to explain. Things like string and sucker tomatoes, and you know that those things like that that can truly and only really be learned by just getting out there and doing it would be hard to learn online. But as far as your pen and paper hands on stuff that you have to do with your calculations, and all is very easily learned online.” (FF-II:40)

Theme 2: Student Engagement and Opportunities

The second theme that emerged from evaluating participants’ interview responses as related to experiences that led to career preparedness was student engagement and opportunities. This section details how student engagement and opportunities outside the classroom and laboratory impacted their career readiness. The sub-themes identified here include travel, clubs and teams, and leadership development.

Travel

Students’ travel opportunities are often offered in individual courses to reinforce in-class instruction and/or to show technologies or practices common in the industry. This often occurs as field trips to the local industry during laboratory instruction. Another example of a travel experience in the Department of Horticultural Science offered to all undergraduates is a yearly field trip in the fall to botanic gardens, plant nurseries, retail plant outlets and other horticulture-related facilities primarily outside of North Carolina. All horticulture students can travel if they are involved in the Student Competition Team. Each spring, the team travels to a different host school for the competition, where they compete in various landscape-related hands-on events against over 60 teams in the nation. Over the years, various educational institutions across the country have hosted, allowing students to visit other states and universities. Study abroad opportunities, and commodity and trade organization conferences, are also opportunities for students to travel within their major.

When asked what other experiences contributed to career success, two students mentioned travel. *Acer* expressed regret for not being financially able to travel. She stated,

“I never went on any of the trips. I'm just so bummed that I never did. It was just never in the cards financially. For me, I was just barely at NC State fund-wise. And so yeah, I just never got to go. But I know that the people who did go on those trips were incredibly impactful. And many of them still talk about it today of just the camaraderie that they built and that they still rely on today among their colleagues.” (OE-II:17)

When asked what experiences should be added to the undergraduate experience *Trillium* appreciated the exposure to agriculture through field trips and stated,

“I would say whenever I got to go on field trips to farms or community gardens, or anything like that, when it, whether it was part of a lab or class or a club. I went on the fall field trip in 2019, and that was a really great experience, because, as someone whose background is not in agriculture, I don't have family connections to that. I didn't get to experience it a lot growing up so every time I had something like that where I was able to visit a farm or a garden, it was a huge help to me, I think, just getting a new perspective.” (VE-II:20-21)

Clubs and Teams

All students participated in developmental and social opportunities and gained great value and connection with other students. Many recommended more involvement, and some expressed regret for not participating in the Student Competition Team or Horticulture Club. The Horticulture Club meets monthly and hosts industry people to come and speak about their careers and how they ended up where they are. The club members also volunteer for a yearly plant sale hosted by a graduate-level group in the department. The Student Competition Team, as described previously, gives students an opportunity to form relationships with other students as they pursue a common educational goal while getting valuable hands-on experience.

When asked what experiences we should add to the undergraduate experience, *Viburnum* thinks clubs and teams were some of the most valuable. He stated,

“I do really feel like some of the most valuable things I got out of my college experience was getting involved in the different clubs and like the competition team and going to conferences and things like doing internships. Learning everything in the class is one thing, but then actually going out and applying it and seeing success in the application is how it really helps you prepare for your career.” (OE-II:15)

He went on to suggest requiring them,

“I feel like the undergrad especially is comprehensive because they give you all these opportunities to do clubs and competitions. Maybe making it a requirement to do something extracurricular, like a club, or the competition team or something, and then somehow keeping track of that could be helpful.” (OE-II:17)

When asked to advise an incoming student he continued by encouraging them to try new things and take opportunities. He advised,

“Be open to trying new things. You know, if there's a class, you're not sure about, or something you may be interested in, just go. Try to take advantage of whatever opportunities arise, and because of that, you know, I end up changing majors. I've gotten to do things I never dreamed I'd be able to do in college, especially coming from a real small town. Opportunities only matter if you know, you take advantage of them.” (AD-II:25)

Acer also talked about the horticulture club and its impact on giving opportunities for students to be involved in the department. She stated,

“I think you know the Horticulture Club does an awesome job. You know, it's a way for everybody to gather in fellowship and to coordinate on projects. I'm glad that I got to be a part of the plant sale just as a volunteer. There are so many skills that you develop working with the plant sale. You know the plant ID, and if you're helping with the division chairs, and obviously really doing a lot of work.” (OE-II:17)

Berberis advises incoming students to join as many clubs as possible and states their importance.

“Join all the clubs that you can fit in your schedule. I think it would be important to join the Horticulture Club. I loved Horticulture Club. It was great. Making those connections with all the different students. Now we're so connected with a lot of people that went to NC State. And I'm thinking the connections are a major part of the education system that's so important that people don't really talk about.” (AD-II:27)

Caladium was active in FFA in high school and attended many competitions. He followed that trend as an undergraduate and competed in the National Collegiate Landscape Competition multiple times. He was also an officer in the Horticulture Club, and those experiences added to his leadership development and skill set. He said,

“The competition team was an experience that helped. I feel great about it, especially

getting someone out of their shell. I think that's a huge part of you knowing what college is supposed to do. And it kind of throws you into being part of a group that shares a lot of similar interests generally. I met friends from my time on the competition team that I still talk to every day.” (VE-II:20)

Narcissus was involved in many clubs and felt incoming students should do the same to prepare for career success. He said,

“Get involved in every club that you possibly can. I was in the YFR, the Horticulture Club, Alpha Zeta, and a few others, and I feel like those experiences help you to make connections all over the state that you can then use in your career later.” (AD-II:48)

Theme 3: Faculty Engagement and Industry Relationships

The third common theme identified among participant responses about experiences that led them to perceive they were prepared for a career in horticulture was faculty engagement and industry relationships. Like most institutions of higher learning, classes for specific majors, like horticulture, are taught from the same building, and each department has its own personality. Students can interact with faculty in the classroom, halls, on special projects, in clubs, and other individual experiences. Participants perceived the influence of and relationships with faculty members to be of great value to their career readiness. The areas identified where students saw the most value in these relationships is detailed in the following sub-themes: learning environment, coursework, and networking and employment opportunities.

Learning Environment

How participants perceived their learning environment and interactions with faculty within that environment shaped their educational experiences. All students in this group benefited greatly from interactions with select faculty members. They mentioned them by name and the influence they had on their decisions and career success. Some were academic advisors, and others were responsible for specific courses. Within the Department of Horticultural Science, students are assigned to academic advisors who also teach courses within the degree programs. Faculty advisors suggest internship recommendations, student involvement

experience and career options.

Miscanthus valued the connections made with specific professors from the beginning to the end of her educational experience. She stated,

“I obviously like having good connections. I think the professors that I had in the horticulture department. The class sizes were small, and you know things were very kind of informal. And so, we were able to develop a relationship that allowed me the confidence and the reassurance to ask them for, you know, recommendations and things like that when the time came.” (VE-II:12)

I also appreciated the friendly environment and tone of the department. She said,

“When I really thought about the kind of environment that I wanted to see myself in long term, I wanted it would have been ideal for me to have a job where I could be outside and then, based on the tour that Helen gave me, I just had the feeling that you know, everyone was really cordial, and professors were very friendly and I think that had a really big impact on me. It wasn't like a cutthroat environment.” (MI-II:4)

On the topic of the learning environment at NC State and subsequent success *Berberis* also credited down-to-earth, quality faculty as creating a welcoming culture. She shared,

“I would add that I think the quality of the faculty is unmatched, and there's no pretentiousness. Everyone is so down to earth. I love that pretty much all the professors, we were on a first name basis with them, and it makes a really big difference, like kind of how you relate to them, and they were always so generous with their time and with their knowledge.” (IT-FG2:117)

Regarding gender, *Acer* talked about the inclusive nature of the department and green industry. She shared,

“I think NC State did a good job of being inclusive. It's a good balance of male and female professors in the green industry specifically in things like landscaping and garden and garden design.” (IT-FG2:102)

Networking and Employment Opportunities

The horticulture industry is closely connected to coursework and curriculum, so students can gain a more significant and impactful network. Through clubs and industry visits, students can meet people already working in the industry, observe current technology used, and grow in business acumen. Having invested faculty members as a resource after graduation was

considered a benefit by participants.

Acer has been in the profession longer than the other study participants. Her current position involved investigative the needs of homeowner and commercial horticulture producers. She has traveled extensively to gardens and production facilities worldwide and held various horticulturally related roles.

When asked to describe how her educational experience prepared her for employment, *Acer* felt his networking and work experience as a student gave her an advantage. She stated,

“I work for Cooperative Extension as a horticulture agent. So, everything that I did as a horticulture student applies all the time. I have the benefit of having worked within the system for 4 and a half years as a student. So, I use all those connections and the way that NC State works and like how everything is organized, I already know that stuff and so I know where to find the information. I know who to contact and just having that network, I use it every single day to help my clients.” (EE-FG2:26)

Narcissus had much experience in general agriculture including animal industry and equipment operation skills, prior to coming to NC State. He was involved in student organizations while an undergraduate and sought out work experiences as a student. He perceived the connections he made during these experiences as valuable networking opportunities that benefit him in his current career. He stated,

“I’m one of the only people here at the research station that has a horticulture background. But I’ve also made connections with everybody around and at NC State a lot of the project leaders before I worked here.” (EE-FG2:32)

Trillium added to the value of networking and stated,

“I think horticulture is such a great degree in general, but specifically at NC State. There were so many ways you could take it, and there were so many options that you have. So many people that you meet that are connected to the industry.” (EE-FG1:116)

Quercus made many connections to the industry and credits those connections to her success. She stated,

“There are not a lot of other places that you can go in North Carolina to get as good of an education. And connections to other people in the industry. As niche as it is, it’s big. There’s a lot of people that know everybody else. Yeah, I think the connections or that

credibility has helped me.” (IS-FG2:93)

Acer got to work with many professors on various projects and noted this as an experience that prepared her for employment. She reflects on those connections,

“I worked with a lot of professors on a lot of different projects. And so just the kind of the breadth and depth that our professors are involved with, it was cool to be able to explore. Lot of different facets of the field of horticulture and then you're working with and learning from the people doing the research and the work and that was insanely awesome.” (FE-FG2:24)

When asked to describe educational experiences related to employment opportunities, *Miscanthus* referred to undergraduate coursework that was useful in pursuing her graduate degree. She stated,

“After my undergraduate degree, I went on to pursue my master's in landscape architecture, but I found that the horticulture degree was a lot more useful. I benefited more and was able to apply more of those skills in the professional world than I did with my master's. And I think that's because horticulture had a more well-rounded approach. I think the course with Barbara Fair regarding landscape management, like soils, was just more holistic. And so, it allowed me to kind of think about, how is a landscape going to be maintained.” (EE-FG1:34)

Theme 4: Professional Skill Set Development

The fourth and final theme identified through participants’ interviews about what experiences they perceived prepared them for a career in horticulture was professional skill set development. Workplaces demand that soft skills be coupled with hard skills for potential employees (Robles, 2012). This section details specific skills they now use in their current jobs that they acquired through their educational experience. The sub-themes are technical skills, soft/human skills, and personal growth.

Technical Skills

Investopedia (2023) defines *technical skills* as “sets of abilities or knowledge used to perform practical tasks in science, the arts, technology, engineering, and math. Technical skills typically require using certain tools and the technologies required to use those tools.” Technical

skills are the basis of NC State's horticulture degree program, and interview results show participants felt well prepared in this area but that there was room for improvement.

Specific technical skills were highlighted by all participants. These included, but were not limited to, plant identification, plant propagation, plant care, soil fertility and plant nutrition, diagnosis of plant issues, and project management (Table 2).

When *Berberis* was asked about what essential skills and aptitudes, she perceived helped prepare her for her career in horticulture, she said she relies on diagnostic skills to identify diseases and post-harvest techniques for cut flower storage. She stated,

“So, I (*Berberis*) think it depends on the season. For strawberries I am looking for diseases and trying to figure out what's wrong with the berries and what we need to spray. So, it is disease and pest management and that's the same with the flowers. When it comes to the horticultural side, I send off a lot of plant samples. So having those skills is the same with soil samples. For horticulture skills I also need to know how to properly cut the flowers at the right stages and knowing how to store them. Post-harvest is really important for us; knowing exactly how to put the temperature correctly in the cooler to get the field heat off the strawberries and what flowers can be put in the cooler.” (IS-II:11)

She went on to say there is a need for more technical skill development and stated,

“If there would just be more experiences surrounding how to run modern operations and how to like, go and install things yourself. I remember in greenhouse production specifically, we never learned how to put a greenhouse up. We never learned how to put plastic on a greenhouse, how to install wiggle wire, but having more hands-on stuff like that.” (VE-II:19)

When asked about essential skills and aptitudes gained during her undergraduate tenure, *Dianthus* says she regularly uses her understanding of whole plant physiology with nutrition and diagnostic skills to diagnose plant problems in the greenhouse and the field. She described how these skills are integrated,

“Skills that I rely on and use regularly are whole plant physiology and understanding nutrition with diagnostics of biotic and abiotic issues for greenhouse management and in the field. I am trying to distinguish between plant pathology and horticulture, and it all just feels integrated. Plant ID certainly. Mostly for weed ID. And yeah, fruit

development, that's important.” (IS-II:16)

Quercus supported her opinion that horticultural skills and aptitudes are best taught in person to reinforce those skills. She perceived plant identification and maintenance estimating as valuable skills gained.

“Plant ID is a horticultural skill that can be applied in other areas, but spatial awareness is like being able to look at something and guess maybe a size. I do a lot of disease identification. So, knowledge about weeds and diseases helped me.” (IS-II:9)

She continued,

“I feel like estimating was a part of one of the classes I had. For the maintenance class if you're doing it with Excel, it's hard. I had Excel in high school, so it's a little bit easier for me. But I did see other people struggle with just the actual program. So, something like that is easier to teach in person. But I feel like nursery management could be online and probably greenhouse management.” (FF-II:23,25)

In her current position, *Trillium* uses many skills acquired during her coursework at NC State and attributes them to success in her current career managing a vineyard for a winery. She identifies specific skills such as yield estimation, pest identification, plant problem identification, fertilizer recommendations, and pesticide management. She explained,

“One of the biggest parts of my current job is data collection for yield estimation. So doing a lot of counting and analyzing data. One of the next biggest ones is probably scouting. So, looking for things like phenology, pests, and disease. Fruit set issues and looking at the cover crop and for water stress and nutritional deficiencies and weeds. I'm also in charge of our fertigation program. So that would include petiole collection and then writing the actual fertilizer recommendations. Pesticide recommendations are determined based on scouting data and in harvest, I'm in charge of maturity sampling and data communication to the ranch leads in the winemaking and then others.” (RE-II:12)

She notes the benefit of having a broad knowledge and skill set from her education and highlights the specific skills learned in plant pathology and plant nutrition as beneficial to career preparedness; she stated,

“I think a huge one would be plant pathology. Not only identifying but understanding what the pest is like. Plant nutrition has been a big skill and that's one of the things that falls squarely on my shoulders. So, I think I have good knowledge of things like fertilizer.

Also, general knowledge of production, agriculture in general, maybe more specific to fruits or vegetables, but kind of understanding the ins and outs of that industry has been important.” (IS-II:16)

When asked what other courses that need to be offered, she suggested,

“The need for some sort of data management course, and just managing data in general is a big part of my job now and I feel like I'm still learning how to use excel like I remember. In one of my labs, I think it was ecology, there was something that we needed to make a graph for, and I couldn't figure out how to do it. But I feel like my knowledge of Excel is lacking, and that is a huge part of my job. I don't know if that would be a horticulture course but maybe it could be a part of a course, or maybe stand alone.” (AC-II:25)

Caladium suggested that the skills he gained through work experience and internships and the work experience in and of itself helped him acquire a job in the horticultural field. He stated,

“I honestly can say, working through college was a great thing for me, too, because in addition to the internships I worked at a local retail nursery and one other place and that was also somewhere I gained a lot of experience. I think really what helped me launch into a career was having work experience when I graduated versus graduating and not having any work experience on a resume.” (AD-II:34-35,39)

Narcissus consistently uses many skills acquired from his undergraduate experience in his current role at a horticultural research station. He described,

“Basically, what I do is all the field work and all the planning work for our vegetable research. So, I take soil samples and make calculations on that. I fertigate everything and basically do anything that you can in a tomato crop and then any other crop that project leaders bring. So, we had tomatoes, cigar tobacco, Christmas trees, squash and cucumbers, and everything like that and some of those soil fertility things and then integrated pest management. It's hard to remember all the stuff because we do it all here.” (RE, IS-II: 14-16)

Additionally, *Fothergilla* identified plant care, propagation, plant identification, greenhouse management, and pesticide management as skills learned from specific courses that had great value in her role as a public garden curator. She stated,

“I am responsible for general plant care, just making sure plants are weeded and watered and pruned and just happy in general. Propagation is a big one especially for rare plants

where we must take cuttings either in the field or from the nursery. Then plant identification and just being able to tell without having to look up the code of the plant. And pulling from some of the things talked about from my greenhouse management course. And some of the facility type things and lots of pesticide stuff, too, since we're spraying pretty frequently for just herbicides.” (IS-II:14)

Soft Skills

When looking for employees, more than technical abilities are necessary to obtain and sustain employment. The Balance (2022) suggests, “Soft skills are non-technical skills that relate to how you work, interact with colleagues, solve problems, and manage your work. They include, but are not limited to, interpersonal (people) communication, listening, time management, problem-solving, leadership, and empathy, among others.” Wilson et al. (2019) identified eleven discrete skills that were categorized through a content analysis of job postings within agriculture and natural resources of bachelor’s degree-holding graduates. Soft skills, like interpersonal and communications, were often preferred over technical skills.

Specific soft skills were identified by all participants. These included, but were not limited to, communication, time management, problem solving, community engagement, general people skills, independence, creativity, stakeholder engagement, relationship building, networking, and resourcefulness (Table 2). These are all valuable skills participants learned during their time at NC State.

When asked about soft skills developed through his undergraduate experience that have contributed to career success, *Narcissus* noted teamwork as an essential skill. He believes,

“Being able to work with others is a big thing, too, you know because if you can't work with others. It's a long row to hoe.” (CS-II:22)

When asked to advise incoming students about soft skills, *Acer* implores students to explore many activities to develop skills like time management and organization. He recommends,

“Explore all these different times and things to do, because when you're at school, you know you are in a little bubble. But there are so many free things to do, and all your job is to go to class and do other stuff to better yourself. So do those things, while at the same time trying to figure out and build a framework. For you know, time management and organization because you need those skills as you continue to progress through your schooling. You need to spend those first 2 years getting a good system down but just participating in the Horticulture Club.” (AD-II:23)

Personal Growth

College is a time of personal exploration and growth for many people. Dewey (2008) suggests that the act of learning, changing, and doing is continual in the human experience and educators should strive not only to provide information and prepare students for graduation but also for the vocation of life. His study not only examines specific skills and aptitudes necessary for receiving a degree in higher education for future work, but also contributes to skills that result in growth and impact at home in communities. Every participant shared they had the opportunity to grow by being part of the Department of Horticultural Science at NC State and how that growth contributed to career success. Specific areas of personal growth were identified from interviews and included. However, they were not limited to making connections, trusting creativity, passion for learning, becoming resourceful, dealing with different people from different backgrounds, developing people skills, and thinking creatively (Table 2).

When asked about valuable experiences that contributed to her personal growth and career success, *Dianthus* recalled her initial rejection from NC State as the first call to focus on her future. She then credits her time at NC State for helping her develop and trust the curiosity, passion, and skills she needed to face unfamiliar challenges after graduating.

“Well, first, my rejection from NC State was the biggest call to focus on my future that I had, and I think about my work with undergrad research. I'm thinking of going to a new place and I was really intimidated to go to university up north. I was really intimidated to leave the South to work in a different climate and series of systems that we're not familiar with. So yeah, a general theme of the unfamiliar which is probably a cheesy answer, of course, that there was a lot of growth that happened. And trusting myself that I could take

a leap, and that I knew my abilities enough, or that I could trust in my curiosity and my passion, and the skills that I had developed at NC State and that I was well positioned.” (VE-II:23,25)

Quercus commented on the growth in confidence as being critical to career success. She stated,

“But now I feel confident in what you do, like having a sense of okay. I have this challenge, but I believe that I am capable of it. I just must push that type of thing. A sense of pride, I feel is pretty good.” (CS-II:10)

Trillium offered advice to incoming students for personal growth. She encourages making friends in degree-related classes and believes in the value of these friendships and networking relationships throughout college and beyond. She stated,

“I was thinking the first piece of advice would just be to make friends in your classes, in particular, the horticulture classes since it is a smaller program. You get to know everyone quick. If you make friends in those classes I, think it makes you a better student, and it also like a lot of people that I met in those classes I’m either friends with today or I’m connected to on LinkedIn. It just gives you someone in your field for life.” (AD-II:30)

When asked whether her career success built on personal growth as an undergraduate student, *Miscanthus* feels she grew in competence and confidence from her educational experience and that it directly translated into career success. She stated,

“There’s no way that the program could have prepared me for everything that you know I would be exposed to. But I think providing a level of competence and confidence to kind of start doing my own thing is probably the closest to professional success or career.” (CS-II:10)

Communication

Communication is a specific soft skill identified as essential to workplace success. During their time at NC State, all participants had opportunities to participate in activities and engage in activities that helped them grow as communicators. They now use these skills developed from their undergraduate experience in their current jobs. Some of these experiences include giving tours, communicating with faculty, and working closely with others.

Communication skills were identified from interviews and included. However, they were not limited to learning the language of horticulture, defining technical terms for non-experts, and making connections with professors and staff (Table 2).

In her time at NC State, *Dianthus* took the opportunity to build her communication skills through public outreach and stakeholder engagement. She stated,

“A lot of my time at NC State was also spent in the ornamental and public garden world. I feel like that was really my introduction to public outreach and stakeholder engagement, and giving tours, and engaging people's interest in their home gardens, and you know, and plants for beauty's sake. And so that I don't know if I had before considered that a horticultural skill. But that seems like something I still rely on when I'm doing Master Gardener training or extension talks or tours and things.” (IS-II:18)

Viburnum commented on the responsibilities of marketing and planning in his current position that relate to communication skills,

“Just in general, marketing and in human interactions with plans and things like that are beneficial. So, I would say, more on the business side of things has been helpful. And especially the people aspect, too, you know. I thought, that's helped me out a lot with my graduate degree research and helped me out in my career. Of eventually hopefully owning a business and then, just, you know, interacting with people in general is important.” (RE-II:11)

Miscanthus advises incoming students to develop communication skills by becoming friendly with professors. She believes this skill will be valuable for professional success. She said,

“Become friendly with the professors and with your peers. You don't know when you'll need a recommendation from them, or if you'll be working together in professional practice.” (AD-II:22)

Fothergilla used a social media platform to communicate with a botanical garden and that helped her acquire the position she has today.

“Having a LinkedIn account ended up being like one of the best things I could have had. I followed the botanical garden on LinkedIn and started posting more frequently. I showed them that I had experience and all that so yeah, those were all kind of like the moments that I could think in my head that made an impact on where I am today.” (VE-II:22)

Chapter Summary

The two research questions guiding this study provided insight into the impactful experiences of undergraduate students in the Department of Horticultural Science at NC State University. Data collected through focus groups and individual interviews were analyzed for themes. Responses from the 10 study participants yielded six themes, and quotes from the participant's responses substantiated the themes:

- Graduates remarked and, in some cases, were surprised at how prepared they were for careers in horticulture. They were satisfied with their overall knowledge of the science of horticulture and their ability to progress into the early stages of their career.
- Participants expressed the value of their education when compared to other institutions and/or friend's educational experiences, and if they had to choose an educational experience, they would choose NC State again.
- The rigor and breadth of instruction, availability of undergraduate research opportunities, the impact of internships and other work experiences, the value of hands-on learning, and face-to-face instruction were instrumental to their academic engagement and training.
- Students expressed appreciation for high-quality student engagement and opportunities, specifically through travel experiences, clubs, and team activities,
- The learning environment from faculty engagement was impactful, and industry relationships developed their professional network, leading to sufficient employment opportunities.
- Technical and soft/human skills developed through coursework, and departmental culture provided personal growth opportunities. Communication skills improved through coursework, departmental activities, and professional development.

CHAPTER 5

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

The purpose of this chapter is to summarize the study by restating the purpose, presenting research questions, and explaining the procedure. This chapter will also present a discussion, conclusions, implications, and recommendations for future practice and research.

This study sought to evaluate perceptions from past graduates from the Department of Horticultural Science undergraduate degree program at NC State University, allowing them to share the value of their experiences. The research questions generated sufficient data. After review, preparation for success, a repeat customer mentality, academic engagement and training, student engagement and opportunities, faculty engagement and industry relationships, and professional skill set development emerged as themes.

Summary of the Study and Procedures

Purpose of the Study

This study aimed to explore the perception of graduates from the Department of Horticultural Science focusing on their undergraduate experiences, and those factors and opportunities designed to enrich learning, thus providing insight on how those experiences influenced readiness for a career in horticulture.

Research Questions

Two questions guided this study:

1. What are the perceptions of recent graduates of the Department of Horticultural Science at North Carolina State University in reference to their preparedness to enter the horticultural field?
2. What were the perceived major experiences that allowed them to be successful

upon entering their careers?

Procedures

This study used a basic qualitative approach and a single instrumental, exploratory case-study design to allow the researcher to gather information from current happenings and in retrospect. It is both a process of inquiry about the case at hand and the product of that inquiry (Frey, 2018). Results can be informative to colleagues interested in evaluating teaching pedagogy with adaptations leading to improved efficacy within a department or college at a prominent university. Due to a small sample size, findings from qualitative inquiry are not intended to generalize to large populations.

The methodology for collecting data included focus groups with ten recently graduated students. This was followed by individualized interviews with the same students regarding specific topics related to their skills and aptitudes that were not highlighted during the focus groups. Participants were selected from graduates from 2015 – 2022, and the focus included those who entered the horticultural workforce across North Carolina.

Summary and Conclusions

Research Question 1: What are the perceptions of recent graduates of the Department of Horticultural Science at North Carolina State University in reference to their preparedness to enter the horticultural field (RQ1)?

The findings from the focus groups and individual interviews highlighted participants perceive they were prepared to enter the horticultural field with the necessary skills and aptitudes for their career in horticulture. Participants remarked about how valuable and impactful the degree program was and how the personal and professional connections made through their undergraduate experience were crucial to their current successes. All participants highlighted faculty members, specific courses, and opportunities as specific references to the

development of their skills and aptitudes attained during their time as a student. These answers to RQ1 yielded these two themes:

1. Preparation for success
2. Repeat customer mentality.

Basinger et al. (2009) suggest horticulture and landscape-related graduates should possess specific skills and aptitudes, and Hendrix (2018) found participants indicated they felt confident in their ability to work independently, demonstrate loyalty, act responsibly, and respect others. In a related manner, this study aligned with the findings as participants highlighted their preparedness to perform technical skills, communicate with others in both personal and professional communities and seek out professional development which led to increased confidence and a feeling of success and preparation. NC State was their avenue to achieve skill development and provided opportunities that were perceived as preparing them to enter the workforce.

The findings from this study also supported the work of Rinker et al. (2020) which highlighted the need for inclusion of critical thinking into curriculum to better prepare students for future careers. All of participants discussed how the courses and/or experiences provided them with a chance to further develop their ability to be prepared for success once entering their career.

Research Question 2: What were the perceived major experiences that allowed them to be successful upon entering their careers (RQ2)?

From the analysis of RQ2, it was concluded that students perceived specific experiences allowed them to be successful upon entering their careers. These experiences were categorized into four themes and are listed into sub-themes below. Participants' responses reinforce the concept in Lent's (1994) theoretical model that goal fulfillment and skill development (obtaining a degree with necessary skills and aptitudes) are built upon activity selection and

practice as experience in their undergraduate education. Student self-efficacy was realized through analysis of whether the perceived significant experiences allowed them to be successful upon entering their careers (RQ 2). Comparing participants' responses to focus groups and interview questions revealed overlap among participants within each theme and sub-theme, confirming data for RQ2.

1: Academic engagement and training

- a. Rigor and breadth of lecture and laboratory instruction
- b. Undergraduate research
- c. Internships and other work experiences
- d. Hands-on learning
- e. Face-to-face instruction

2: Student engagement and opportunities

- a. Travel
- b. Clubs and teams

3. Faculty engagement and industry relationships

- a. Learning Environment
- b. Networking and employment opportunities

4. Professional skill set development

- a. Technical
- b. Soft skills
- c. Personal growth
- d. Communication

These findings supported the work of Bampasidou et al. (2016) who found that high-impact learning experiences are vital to a student's educational journey. All the participants in this study highlighted courses, hands-on learning, labs, clubs, and opportunities with faculty. One participant talked about an opportunity they did not participate in but wish they would have because of witnessing their friend's participation. Students viewed these high-impact experiences as being just as valuable as the in-class coursework.

Dunn (2013) emphasized the importance of faculty involvement and its relationship to retention and success which was also found to be an integral component of the research participants. They all identified specific faculty they worked with on research projects, lab activities, or sought advice and the role those faculty played in their lives.

Those participants who had the opportunity to participate in internships also shared how those experiences further shaped their interest in the horticulture industry and their desire to pursue a career in the horticulture industry. Like the findings of Anderson (2015), Baranko (2015), Stofer (2021), this research also showed the value internships play in supporting students' growth both personally and professionally. One student shared how the internship provided her with an area where she needed more training which led her to pursue a specific class catering to that knowledge area.

Implications

The Department of Horticultural Science at NC State University has historically strived to provide high-quality educational experiences and opportunities to students at all academic levels. The students express gratitude for the workforce preparation, skills, and aptitudes gained during their academic tenure. Professors, researchers, and extension professionals provide instruction, guidance, mentoring, networking opportunities, and extensive internship experiences.

In an ever-changing world, it is imperative that institutions of higher learning continually evaluate whether they are effectively preparing graduates for careers in their field of study. This study only included ten graduates from 2015-2022 and is limited to the scope of the economy, events, and climate of the industry during the 7-10 years those students were in school. It will be essential to continue to evaluate program offerings and their effectiveness. The Department of

Horticultural Science formerly offered international travel as an experience for students.

Undoubtedly, graduates from that era would have a different perspective than those not offered that experience. Participants could only evaluate the classes and experiences they chose to participate in. A different group of graduates may have different recommendations based on their experiences. Therefore, repeating similar inquiries to survey future graduates is recommended.

Participants viewed many experiences as crucial in preparing them not only for a career in horticulture but also for the Vocation of Life as suggested by Dewey (2008). This study suggests: 1) high-impact experiences enhance graduate readiness, 2) students in this horticultural cohort perceived preferred face-to-face learning more so than online, 3) the environment created by faculty is critical to learning and career preparation, and 4) hands-on training and proper curricular structure yields prepared students.

High-impact experiences like travel, club activities, internships, and undergraduate research proved to be impactful in the acquisition of skills and knowledge and ultimate preparation for the workforce. Most participants indicated involvement in one or more of these experiences and credited it as essential to current career readiness. Hall (2017) researched capstone experiences to measure their impact on learning and career preparation. These included internships, undergraduate research experiences, formal courses, study abroad, and independent studies. Most participants in these types of experiences reported that the experience helped them prepare for their careers. Ninety percent of alums felt the capstone experience led to career success. Anderson also (2015) determined that the students and employers evaluated perceived value of internship experience. New information and techniques were learned, and the experience provided an opportunity to explore a potential career due to first-hand knowledge of careers in their area of interest. Feldpausch et al. (2019) reported that 82% of undergraduates

ranked relevant work experience, in this case, on-farm work experiences, as most critical. The study also suggested that universities offer on-campus work experiences as a convenient way to gain experience. In conjunction with Hall's (2017) and Anderson's (2015) findings, it is recommended that horticultural science degree programs continue to offer, encourage, and possibly require students to participate in high-impact experiences to be career-ready. If programs do not already include these opportunities, their development, and inclusion would only enhance their program offerings and further prepare students for careers in horticulture and related sciences.

Curriculum evaluation and reform to measure learning and keep academic entities accountable for that growth is an industry expectation. As curriculum was evaluated in this study, participants' views on class delivery methods were one way to measure whether curriculum offerings were still meeting those expectations. Distance education has been a popular and emerging teaching platform for years, and the COVID-19 pandemic has pushed education entirely online for multiple semesters. In a post-COVID world, some might assume that this might be a preferable way for students to learn based on its flexibility since much learning could be moved online. Some participants of this study graduated before the pandemic, while others experienced both in-person and online instruction. Participants expressed that they felt face-to-face instruction was best when asked about the value of face-to-face instruction versus online. Topics like business, economics, and even writing could remain effective through online instruction, but tactile courses with hands-on components and in-person instruction are lacking when offered online.

The environment created by faculty is critical to learning and career preparedness. Several research participants indicated that specific relationships and experiences with faculty and staff in the Horticultural Science department were essential and helped prepare them for their

careers in horticulture. Participants interacted with faculty in class and laboratory settings through undergraduate research, internships, networking, travel, and advising. Students even mentioned some of these individuals by name, crediting them for their influence and impact on their decisions and career success. This shows the investment of faculty in students throughout their education and beyond.

The horticulture industry is closely connected to coursework and curriculum, so students can gain a more significant and more impactful network. Through clubs and industry visits, students can meet people already working in the industry, observe current technology used, and grow in business acumen thanks to arrangements by faculty. Having invested faculty members as a resource after graduation was considered a benefit by participants.

This means having passionate, caring, and well-trained faculty is essential to provide a high-quality educational experience. When faculty create effective learning environments, students develop a sense of belonging and purpose. Learners will thrive in an environment where educators facilitate “world readiness,” offer a 21st-century education that broadens horizons and stimulate curiosity. Additionally, they should strive to involve the discovery of fields of knowledge, ways of knowing, and perspectives well beyond what most students have encountered in high school (The Equity-Excellence Imperative, 2022).

Researchers (The 6 College Experiences Linked to lifelong success, 2019) found that six elements of the undergraduate experience had a significant effect on a student’s post-graduation success:

1. A professor who made them excited to learn;
2. A professor who cared about them as individuals;
3. A mentor who pushed students to reach their goals;

4. Working on a long-term project;
5. Completing a job or internship related to classroom lessons;
6. Being engaged in extracurricular activities and groups.

Only 3% of students said they “strongly agree” they had all six experiences, and among graduates who strongly agree their schools prepared them well for life, 82% reported experiencing all six, compared with just 5% who say they experienced none. Researchers also found that the six experiences are connected to time-to-completion: 75% of graduates who “strongly agreed” they experienced all six finished their degrees in four years—while that rate fell to just 61% for respondents who reported experiencing none.

Considering these six elements and study participants’ testimonies about their experience in the Department of Horticultural Science at NC State, faculty, and staff investment in relationships with students made them more prepared and empowered for the workforce.

A final takeaway from the results is that hands-on training and proper curricular structure yield prepared students. A comprehensive horticulture program provides opportunities for students to grow in technical skills, develop soft skills, personal growth, and the chance to practice communication skills. The broad scope of courses provided by the Department of Horticultural Science at NC State and the content, in conjunction with their hands-on nature, allows participants to grow in all these areas. Students remarked that hands-on training and experience were instrumental in their career preparation, especially for courses like plant identification, plant propagation, and plant pathology. In addition, upon entering the workforce, they could look back on skills acquired and make recommendations for improvement.

The current model of instruction in the Department of Horticultural Science is of lecture and laboratory learning experiences. Each course builds from foundational information to

mastery of subject matter, and with that intentional course sequencing, the science and theory of these courses are reinforced in the greenhouse, laboratory, and field environments. All of which include hands-on components of learning. Internships, field trips, and undergraduate research projects are also experiences that offer the opportunity for hands-on experience.

Students gain confidence through hands-on training and experiential learning opportunities. It was discovered that capstone courses are helping to prepare students to enter the workplace based on the needs of the industry and provide students with skills and opportunities that are transferred to the workplace and the day-to-day aspects of the agricultural industry (Rinker, 2020).

Based on this study and supported by previous research from Rinker (2020) and DuPre (2011), hands-on training and proper curricular structure yield prepared students. When possible, students need to have hands-on opportunities to develop technical skills, soft skills, personal growth, and communication to effectively prepare for a career in horticulture. Currently, the Department of Horticultural Science at NC State University delivers in all these areas. Recommendations for continuation of high quality, rigorous course and lab work that allows for student development in these areas in a hands-on setting, and suggestions for improvement, will help this department and others like it remain competitive in graduating confident, equipped, and successful graduates.

In addition to offering high-impact experiences, prioritizing face-to-face learning when possible, enhancing online delivery by seeking quality matters certifications, hiring well-trained and caring faculty, and emphasizing hands-on training within a comprehensive curricular structure is important. Participants made a few other specific recommendations for improvement when asked what courses should be added to the curriculum and what could be improved in their

undergraduate experience. Participants recommended adding courses to the undergraduate curriculum in conservation, sustainability, and horticulture applied business management. One participant suggested increasing the frequency of required course offerings. Another participant suggested teaching how to use a dichotomous key in Plant Identification courses. Based on participant feedback, it is also recommended the department invest more in technology like AUTOCAD for landscape design courses and currently used plant production equipment, as it is important when preparing students to be competent, confident, and capable in the workforce.

Aristotle famously coined the phrase “The whole is greater than the sum of its parts.” We see this concept reflected in the conclusions of this research study. No one experience, no matter how valuable, standing alone could be credited as the sole reason participants felt prepared for their careers in horticulture. Rather, the sum of all experiences offered in their undergraduate experience made it possible for their educational experience to total a more valuable whole.

Connections to Theoretical Framework

In alignment with Lent’s (1994) theoretical model, students chose the Department of Horticultural Science with the expectation that they would find experiences related to their interests and participate in activities that would satisfy their learning goals. As their experience and academic tenure progressed, their self-efficacy and confidence grew, and students remarked how valuable and impactful their educational experience was and that connections made through it were crucial to their current successes. The idea of an iterative process, where the cycle of decision-making occurs repeatedly, was evident in the participants’ responses. The dynamic and ever-changing nature of their academic experiences led to improved decisions and career choices.

Additionally, Lent’s (1994) idea of performance and persistence in educational and occupational pursuits, reinforces this concept of goal fulfillment and skill development. Student

self-efficacy, as related to Proposition 7 where interests affect entry behaviors (actions) indirectly through their influence, was realized through analysis of whether graduates perceive they were prepared to enter the horticultural field with the necessary knowledge and skills (RQ1).

Dewey (2008) believed that reality must be experienced, and humans learn through a 'hands-on' approach. This point of view proposes students must interact with their environment to adapt and learn. Based on this study's participant responses, the hands-on teaching model utilized by the Department of Horticultural Science yields graduates who exhibit workforce readiness and can perform tasks necessary for early career success. Specific experiences with internships, travel experiences, and undergraduate research were mentioned as valuable.

Recommendations for Future Practice

While this study cannot be generalized, it is recommended that Horticultural Science degree programs at NC State and equivalent programs should:

1. Continue to offer, encourage, and possibly require students to participate in high-impact experiences to be career-ready. If programs do not already include these opportunities, their development, and inclusion would only enhance their program offerings and further prepare students for careers in horticulture and related sciences.
2. Seek to support, recognize, and reward staff and faculty members who create opportunities for students and seek to hire individuals with the capacity and heart to provide these opportunities. Teaching faculty should include individuals who possess hands-on, transferable skills, those who wish to include students in professional organizations and experiences, research faculty and staff willing to partner with students in undergraduate research, and academic advisors who will take the time to help students

select activities and practices as they take steps to fulfill their goals as compared to the study's theoretical model (Lent et al.,1994).

3. Continue to strive for high-quality, rigorous course and lab work that allows students to develop both technical and soft skills, experience personal growth, and learn communication skills in a hands-on setting. This could include capstone course offerings.
4. Consider alumni recommendations for program improvement as they apply to course offerings, specific course content, and technology.
5. Provide scholarship opportunities for students to travel since finances limited a few participants from participating in impactful travel experiences.

Recommendations for Future Research

From the findings of this research, it is recommended that more research be conducted surrounding the hiring processes of departments at Research One (R1) institutions and determine the objectives of the hiring process. Is it to primarily generate research revenue, or should it be to hire faculty that can conduct research with a dual focus on high-quality teaching and instruction? It should also be determined how universities evaluate and compare the value of teaching in the Reappointment, Promotion, and Tenure process and develop equitable measures of teaching compared to research, extension, and other scholarly activities. With a focus on high-quality academic instruction, institutions can better allocate resources, and students can expect workforce readiness upon graduation.

Quantitative research on specific initiatives and activities that enhance the educational experience should be conducted. Undergraduate coordinators and curriculum decision-makers will want to evaluate the impact of existing and new initiatives. A way to accomplish this could be to choose one initiative or activity, like internships or undergraduate research, and study the differences in immediate outcomes and the relationship to skills and aptitudes that transfer to the

workforce.

This study included questions related to face-to-face and online instruction. Participants in this study felt that delivering major coursework in person for lectures and laboratory was most impactful so that graduates are prepared for an industry that demands them to be hands-on. However, further research within a larger population would be needed to substantiate these findings and to verify the application to other institutions. To validate this idea, participants from institutions that offer a fully online degree in horticulture should be surveyed.

Based on study findings, it is recommended to continue to evaluate program offerings and their effectiveness. Participants were only able to evaluate the classes and experiences they chose to participate in. Future studies may reveal different recommendations based on their experiences. Therefore, repeating similar inquiries to survey future graduates is recommended.

Related to learning goals and factors and experiences that impact career readiness, NC State University's Packways: Learning by Doing initiative was selected as the 2024-29 Quality Enhancement Plan topic. This QEP focuses on high-impact experiences and is part of a university-wide project focused on enhancing student learning and student success. Upon completion, a comparison could be made to the findings of this study to find similarities and differences.

Lastly, this research included only graduates working in horticultural fields. However, it did not include those who graduated from the Department of Horticultural Science who are now working outside of the horticulture industry. Further research is needed to determine if the reason they chose a career outside of horticulture was related to unpreparedness or other factors.

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APPENDICES

Appendix A

PARTICIPANT CHART

Student description	Alumni tenure	Current employer
1 NC Cooperative Extension Agent	9 years	NC Cooperative Extension
2 Entrepreneur/Farmer	6 years	Family Farm
3 Private Gardener	6 years	Private Estate
4 Graduate Student	5 years	University in Northeast United States
5 Public Garden Curator	5 years	Botanic Garden in the Southeastern United States
6 Landscape Designer	5 years	Landscape Design/Build Company in central North Carolina
7 Research Technician	4 years	NC State University/USDA - Research Station
8 Landscape Designer	3 years	Landscape Management company in North and South Carolina
9 Viticulturist	3 years	Prominent vineyard in California
10 Graduate Student	2 years	NC State University - Horticultural Science
11 (Pilot Participant) Extension Agent	3 years	NC Cooperative Extension

Appendix B

INTERVIEW PROTOCOL

Date: August 18, 2023

Study Title: Interview Protocol for a Case-Study on the Department of Horticultural Sciences Academic Program's Impact on Recent Undergraduates and Development of Skills and Aptitudes for Subsequent Career Success

NC State eIRB #: 26289

Funding Source: College of Agriculture and Life Sciences

Dear Robert Ivy,

The research proposal named above has received administrative review and has been approved on August 18, 2023, as exempt from the policy as outlined in the Code of Federal Regulations (Exempt d.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review.

This approval for this research study does not expire, but any changes must be approved by the IRB prior to implementation in accordance with the NC State university regulation and IRB unit standards.

NOTE:

1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NC State University projects, the assurance number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation in accordance with the NC State university regulation and IRB unit standards.
3. If any problems occur, they must be reported to the IRB office within 5 business days.

To request an official, signed approval letter on NC State letterhead, please submit a request on our website under "Request a Letter"

Sincerely,

Institutional Review Board (IRB) Director
North Carolina State University
irb-director@ncsu.edu
919.515.8754

Appendix C

REQUEST FOR PARTICIPATION

Hello! I hope this message finds you doing well.

You may know me, but if not, my name is Lee Ivy and I serve as the director of the NC State University Agricultural Institute. Prior to this role, I was a Senior Lecturer in the Horticulture Department at NC State and really enjoyed my work with students which led to my interest in this research study and the final step in completing my doctoral degree.

With that, would you be willing to help me? I'm conducting qualitative research for my doctoral dissertation and would like to interview recent HortPack grads (that's you) about experiences and skills utilized in current professional positions.

Two questions will be used to frame this study:

- 1. What are the perceptions of recent graduates of the Department of Horticultural Science at North Carolina State University in reference to their preparedness to enter the horticultural field?*
- 2. What were the perceived major experiences that allowed them to be successful upon entering their careers?*

Through the data collected, findings will be used to enhance or develop further initiatives within a college of agriculture to be more accommodating to industry-related technological advances and student learning needs.

I'm beginning with focus groups of 4-6 participants and then following up with one-on-one interviews with each participant. Issac Lewis (administrative support specialist for undergraduate programs in the Department of Horticultural Science) helped me choose you based on varied experiences you had at NC State and the areas of horticulture you have chosen at this point in your career.

What does this involve?

- Zoom focus-group interview with a few other individuals on Tuesday, September 19th at 6p or Tuesday, September 26th at 12:00p (noon)? I will try to keep our time to one hour or less.
- Then a follow-up individualized interview

If you are willing to participate, please let me know by **Wednesday, September 6th**, which date works best for you and your **current email address**. Following your email, I'll send a Zoom link and a few questions to ponder before we meet. If you would like to participate but these times do not work for you, please let me know and I can find an additional time. If you are unable to participate at this time, just let me know and I will remove your name and email from my list. My email address is Lee_Ivy@ncsu.edu.

Please note, the Zoom session will be recorded for coding and developing themes, but your name and any identifiers will **NOT** be used when presenting the findings of this study. Following this research study, the zoom recording will be deleted. Only myself and my committee chairs will have access to the recordings as they assist me with the coding of the research. You do not have to participate in this project and at any time can opt out of the process.

Should you have any questions, please do not hesitate to reach out.

Thank you in advance!

Appendix D

PARTICIPANT INTERVIEW PROTOCOL

Participant Interview Protocol

Interview Protocol for a Case-Study on the Department of Horticultural Sciences Academic Program's Impact on Recent Undergraduates and Development of Skills and Aptitudes for Subsequent Career Success

Research Questions

Focus Group Questions (pertinent to Research Questions 1 & 2)

1. How did you find out about the degree programs at NC State?
2. What was your favorite experience while a student in Horticultural Science?
3. How do you as a graduate of the Department of Horticultural Sciences describe your educational experiences now that you have taken a professional position? (pertinent to RQ 1)
4. Which horticulturally related courses did you take online while at NC State? For those you took, please expand on the class setup and format of the course.
5. During your educational tenure at NC State, do you think there were differences between educational attainment when content was delivered face to face versus online? If so, please explain. (pertinent to RQ 2)
6. What learning experiences do you describe as most effective at preparing you for your professional roles? (pertinent to RQ 1)
7. What specific skills gained from your education are you using in your professional career? (pertinent to RQ 1)
8. Which specific courses were instrumental in preparing you for your career? (pertinent to RQ 1) For those you took, what made them instrumental in preparing you for your career?
9. Anything else that you would like to share related to the impact of your time at NC State and its preparation for career success. (pertinent to RQ1)

Semi-structured follow-up individual interview questions

1. Tell me about your background.
2. What were the major influences on your decision to pursue a horticulture degree at NC

State?

3. Describe your responsibilities in your current position.
4. What horticultural skills and aptitudes are most important to you in your career?
(pertinent to RQ 1)
5. What do you view as career success?
6. What other experiences have contributed to your career success. If brought up, did you perceive a difference in career success between face-to-face and online students or those that enrolled in both? Please explain. (pertinent to RQ 2)
7. What experiences do you think we should add to the undergraduate experience?
8. Are there courses that you think should have been taught?
9. What hands-on experiences do you need in your career, and can those be learned online, or do they need to be taught in a face-to-face format? (pertinent to RQ 2)
10. What advice would you give to an incoming student?

Dates/Times of Focus Groups: Sept 19th - 6p, Sept 26th -12p,

Communication Method: Zoom/online meeting

Interviewer/Researcher: Lee Ivy

Participants: 10 alumni

Memo to participants and follow-up request

Hi all! I hope this message finds you doing well.

Would you be willing to help me? I'm conducting Qualitative Research for my Doctoral Dissertation and would like to interview recent HortPack grads (that's you) about experiences and skills utilized in current professional positions.

I'm beginning with a focus group and then following up with one-on-one interviews as needed.

Would each of you be available for a Zoom focus-group, XXday, XXX at XXp? I will try to keep it to 45 mins or less.

If so, please send me a current email and I'll send a zoom link and a few questions to ponder before we meet.

You do not have to participate in this project and at any time can opt out of the process. Thanks in advance.

Lee

Hi all,

Thank you again for helping with my study and the time you gave to the effort a couple of weeks ago. I have ten follow up questions. If you wouldn't mind, please answer in an email reply or if you would rather, you can call me on my cell# 91977xxxxx if that is better for you.

Dates/Times of Focus Groups: Oct 17th - 6-7:30p, Oct 19th -12-1:30p, Oct 24th - 12-1p, Oct 25th -12p, Oct 26th - 12p

Communication Method: Zoom/online meeting

Interviewer/Researcher: Lee Ivy

Participants: 10 alumni

Semi-structured follow-up questions:

1. Tell me about your background.
2. What were the major influences on your decision to pursue a horticulture degree at NC State?
3. Describe your responsibilities in your current position.
4. What horticultural skills and aptitudes are most important to you in your career? (pertinent to RQ 1)
5. What do you view as career success?
6. What other experiences that have greatly contributed to your career success. If brought up, did you perceive a difference in career success between face-to-face and online students or those that enrolled in both? Please explain. (pertinent to RQ1)
7. What experiences do you think we should add to the undergraduate experience?
8. Are there courses that you think should have been taught?
9. What hands-on experiences do you need in your career, and can those be learned online, or do they need to be taught in a face-to-face format? (pertinent to RQ1)
10. What advice would you give to an incoming student?

Thank you in advance.

Lee

Appendix E

CODING PROTOCOL

Coding protocol (Focus Group)

1. How did you find out about the degree programs at NC State?
2. What was your favorite experience while a student in Horticultural Science?
3. How do you as a graduate of the Department of Horticultural Sciences describe your educational experiences now that you have taken a professional position? (pertinent to RQ 1)
4. Which horticulturally related courses did you take online while at NC State? For those you took, please expand on the class setup and format of the course.
5. During your educational tenure at NC State, do you think there were differences between educational attainment when content was delivered face to face versus online? If so, please explain. (pertinent to RQ 2)
6. What learning experiences do you describe as most effective at preparing you for your professional roles? (pertinent to RQ 1)
7. What specific skills gained from your education are you using in your professional career? (pertinent to RQ 1)
8. Which specific courses were instrumental in preparing you for your career? (pertinent to RQ 1) For those you took, what made them instrumental in preparing you for your career?
9. Anything else that you would like to share related to the impact of your time at NC State and its preparation for career success.

Coding protocol (Follow-up in-person or Zoom interview)

1. Tell me about your background.
2. What were the major influences on your decision to pursue a horticulture degree at NC State?
3. Describe your responsibilities in your current position.
4. What horticultural skills and aptitudes are most important to you in your career? (pertinent to RQ 1)

5. What do you view as career success?
6. What other experiences that have greatly contributed to your career success. If brought up, did you perceive a difference in career success between face-to-face and online students or those that enrolled in both? Please explain. (pertinent to RQ 2)
7. What experiences do you think we should add to the undergraduate experience?
8. Are there courses that you think should have been taught?
9. What hands-on experiences do you need in your career, and can those be learned online, or do they need to be taught in a face-to-face format? (pertinent to RQ 2)
10. What advice would you give to an incoming student?

Main code	Secondary code Researcher's comments
	NC State gave them the opportunities they needed to be prepared for their job in the horticultural field.
	If participants had to choose to pursue a degree in horticulture again it would be from NC State University.
Academic engagement and training	<ol style="list-style-type: none"> a. Rigor and breadth of lecture and laboratory instruction b. Undergraduate research c. Internships and other work experiences d. Hands-on learning e. Face-to-face instruction
Student engagement and opportunities	<ol style="list-style-type: none"> a. Travel b. Clubs and teams
Faculty engagement and industry relationships	<ol style="list-style-type: none"> a. Learning environment b. Networking and employment opportunities
Professional skill set development	<ol style="list-style-type: none"> a. Technical skills b. Soft skills c. Personal growth d. Communication