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# Investigating Students' Career-Readiness in the Agricultural Sciences: A Phenomenological Case Study

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The agricultural industry lacks qualified workers, suggesting students may not participate in opportunities that effectively develop their employability skills. We used a phenomenological case study approach to investigate Texas A&M University College of Agriculture and Life Sciences students' career-readiness and factors influencing career-readiness. We conducted interviews with 19 juniors and seniors. Open coding procedures revealed five emergent themes—*Career Advice-Seeking Behavior*, *Employability Skills Development*, *Network Establishment*, *Relevant Experiences*, and *Personal Growth*. Findings indicate that students do not take advantage of University resources to help them with career preparation. Findings also revealed a lack of employability skills development, especially relating to students' communication and science communication skills. Students identified high-impact experiences they believed improved their employability skills. We recommend strategies for educators to improve agriculture students' career-readiness and offer research recommendations to examine career-readiness factors that may help prepare students to meet 21st century agricultural workforce demands.

**Keywords:** agriculture students, career-readiness, employability skills, high-impact experiences, phenomenology

## Introduction

Higher education in agricultural science aims to prepare a skilled workforce to address unique and complex challenges facing the industry (Roberts et al., 2016). Students studying agricultural sciences and agricultural social sciences who are well-

prepared for the workforce must demonstrate effective employability skills, or competencies in areas such as communication, decision-making, problem-solving, self-management, teamwork, leadership, and professionalism (Crawford et al., 2011). However, the industry "struggles to fill positions with qualified agricultural workers" (Alston et al., 2020, p. 1). This suggests students may not develop effective employability skills—the skills and personal attributes applicable to all careers and industries—during their degree programs (Suarta et al., 2017), leaving them unprepared to meet 21st century agricultural workforce demands.

Often, students develop employability skills through participation in high impact experiences, or "educational experiences that purposely increase student engagement, learning, and collaboration" (Bielecki et al., 2018, p. 2). Goulette and Denney (2018) added to the definition and claimed that high impact experiences often occur outside of the classroom. Such experiences can take many forms, but Kuh (2008) claimed that they are effortful, relationship-building, knowledge-transferring, feedback-providing, diversifying, and reflective. Kuh (2008), and his colleagues at the American Association of Colleges and Universities (AAC&U, n.d.), identified 10 types of high impact experiences: "(a) first-year seminars and experience; (b) common intellectual experiences; (c) learning communities; (d) writing-intensive courses; (e) collaborative assignments and projects; (f) undergraduate research; (g) diversity/global learning; (h) service learning, community-based learning; (i) internships; and (j) capstone course and projects" (Bielecki et al., 2018, p. 2). Students should participate in at least two high-impact experiences during their college career or, ideally, one each year in college (Kuh, 2008).

Undergraduate research involvement has been recognized as a high-impact experience that helps students develop employability skills because they "delve in-depth into problems and work to find solutions using appropriate research methods" (AAC&U, n.d.; Bielecki et al., 2018; Kuh, 2008; Suvedi et al., 2016, p. 16). California Polytechnic State University agribusiness alumni perceived that participating in undergraduate research helped them learn to work independently, problem solve, communicate verbally, and gain a sense of accomplishment (Hamilton et al., 2013). They also believed participating in undergraduate research improved their analytical, critical thinking, self-confidence, and written communication skills most. In addition, Marsh et al. (2016) found that participation in an agriculture-oriented research internship improved students' written, oral, interpersonal, and professionalism skills most, and helped them become more responsible, while their research mentors believed it improved students' sense of initiative, dependability, and punctuality.

Study abroad programs have also been recognized as high-impact experiences that contribute to students' development of employability skills (Kuh, 2008). For example, Texas A&M University students who participated in "agriculture-based, short-term, faculty-led study abroad programs" perceived gains in their "communications, global awareness, flexibility, adaptability, and intercultural skills" (Vetter & Wingenbach, 2019, p. 164). Similarly, University of Florida students' critical thinking skills were enhanced through their involvement in a short-term agriculture-based study abroad program (Roberts et al., 2018). Immersive study abroad experiences also contributed to University

of Georgia College of Agricultural and Environmental Sciences students' development of critical thinking, problem-solving, interpersonal, self-management, teambuilding, and communication skills (Deloach, 2011). Through study abroad, students advanced their sense of initiative, cultural awareness, and personal growth, and expanded their network. Students considered *future employability* (Bielecki et al., 2018) and *career goals* (Deloach, 2011) as important factors motivating their participation in a study abroad program.

In addition to the high impact experiences described above, collegiate club involvement can improve agriculture students' employability skills and career-readiness (Feldpausch et al., 2019; Truax, 2020). To obtain their desired career, Purdue University College of Agriculture students considered relevant work experience, professional networking, advising/mentorship, and collegiate club participation as the most important success factors (Feldpausch et al., 2019). Likewise, California State University, Fresno agriculture students' involved in a collegiate club perceived they had higher task management, active initiative, and social competence skills when compared to those who were uninvolved (Truax, 2020). Students who held a leadership position in these clubs indicated even higher perceived skill levels in these areas, and in the areas of achievement motivation, task leadership, intellectual flexibility, and self-confidence.

Some studies identified factors influencing agriculture students' development of specific employability skills. For example, networking significantly influenced University of Georgia's college of agriculture ambassadors' decisions to become college ambassadors (Edmonds et al., 2016). Ambassadors shared experiences that led to communication skills development, including networking, interacting with industry professionals, working in teams, managing people, holding membership in a professional organization, and observing effective and ineffective communicators (Edmonds et al., 2016). Similarly, "organizational involvement, community service participation, and leadership education" improved University of Missouri College of Agriculture, Food and Natural Resources students' leadership skills (Kovar & Simonsen, 2019, p. 91). Such experiences enhanced students' capacity to build "a group's vision and purpose through shared aims and values" and connect responsibly to the community, "fostering interdependence and a responsibility for the welfare of others" (Kovar & Simonsen, 2019, p. 97).

Faculty-student relationships also play a critical role in agriculture students' career-readiness (Phelps, 2020). Career and technical education students in higher education found inspiration and career direction through their relationships with faculty (Davis, 2021), and such relationships improved retention of preservice agricultural education teachers (Smith et al., 2020). Faculty-student relationships help students "integrate into their collegiate environment and develop a commitment to their institutions" (Williams-Warren, 2020, p. 26). They also help students expand their professional networks and collaborations (Strayhorn, 2012).

Similar to the context of our study, multiple scholars have investigated Texas A&M University students' development of employability skills using survey research designs (Bielecki et al., 2018; Norris et al., 2019; Parrella et al., 2023). When considering their communication skills development, Texas A&M University agriculture students

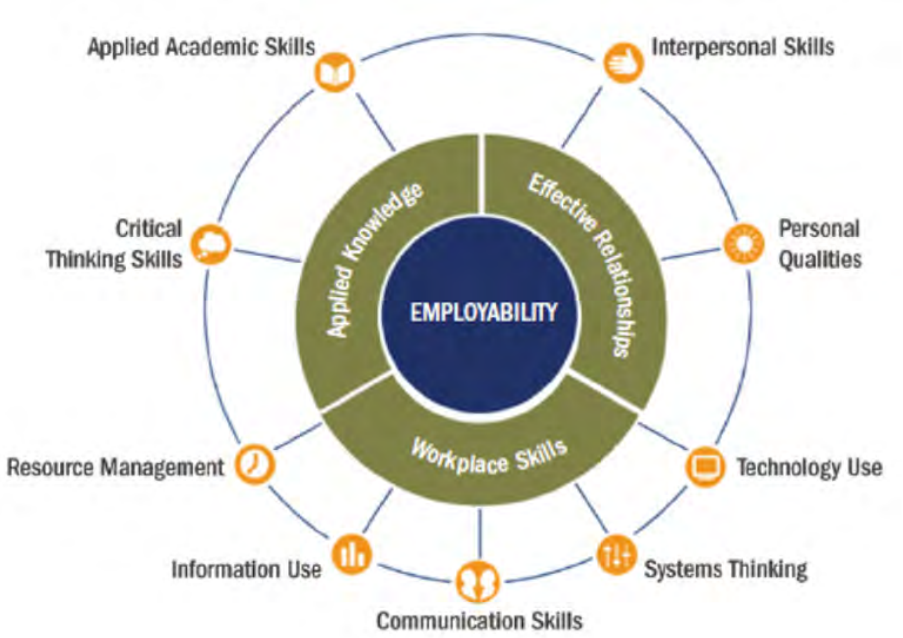
believed their ability to listen effectively was most developed and their ability to ask effective questions was least developed (Norris et al., 2019). They also perceived statistically significant gains in their communication skills the longer they were enrolled in college (Norris et al., 2019). Most recently, Parrella et al. (2023) found that seven types of experiences—"teamwork, leadership, project management, related work or internships, community engagement, cross-disciplinary, [and] international"—significantly increased Texas A&M University agriculture students' "perceived development of communication skills, decision-making skills, leadership skills, professionalism skills, self-management skills, and teamwork skills" (Crawford et al., 2011; Parrella et al., 2023, p. 14).

None of the studies investigating Texas A&M University students' development of employability skills used a phenomenological approach, which we believe is important because students may have inflated perceptions about their skill levels. Phenomenology could reveal students' authentic competencies and feelings, rather than relying solely on perceptions (Smith et al., 2009). Because students are primary consumers of a college program's services, they are critical to assessing college experiences (Suvedi et al., 2016) and can provide the most important program improvement feedback (Corts et al., 2000). Seniors, in particular, can reflect on their overall college experience and connect their experiences to perceived career-readiness (Suvedi et al., 2016). Therefore, we conducted a phenomenological study and interviewed juniors and seniors in the Texas A&M University College of Agriculture and Life Sciences.

**Conceptual Framework.** We used the U.S. Department of Education's Office of Career, Technical, and Adult Education's (2017) employability skills framework to develop the interview protocol (see Figure 1). The framework was developed to "leverage and connect the efforts of policy makers, educators, and employers" (U.S. Department of Education, 2017, para. 1). According to the framework, employability skills fall into three categories: applied knowledge, effective relationships, and workplace skills. We used the three categories to represent our operational definition of *employability skills* and to develop the interview protocol. We do not know if students in our sample were aware of the framework at the time we conducted our study.

**Figure 1**

*U.S. Department of Education's Office of Career, Technical, and Adult Education's (2017) Employability Skills Framework*




Applied knowledge integrates applied academic skills and critical thinking skills. Applied academic skills include scientific reasoning, mathematic strategies, reading skills, and writing skills. Critical thinking skills include thinking critically and creatively, decision making and problem solving, and planning and organizing. Students' applied knowledge is evident in their homework, classwork, group work, presentations, and question-and-answer segments during lessons (U.S. Department of Education, 2017).

Effective relationships require the development of interpersonal skills, such as teamwork, leadership, conflict resolution, and respecting individual differences. These competencies are evident when students work with a partner or in small groups. Personal qualities, which are regularly displayed through daily classroom actions, contribute to effective relationships. Personal qualities include one's ability to demonstrate responsibility, integrity, professionalism, willingness to learn, initiative, self-discipline, and a positive attitude. They also affect one's ability to adapt to change, work independently, and display self-worth (U.S. Department of Education, 2017).

Workplace skills include competencies such as resource management (i.e., managing time, money, and personnel) and information use (i.e., locating, organizing, using, analyzing, and communicating information). Communication skills (i.e., communicating verbally, listening actively, comprehending written material, conveying information in writing), systems thinking (i.e., understanding, using, monitoring, and improving systems), and technology use are also workplace skills. Students are expected

to be competent in workplace skills upon entering the workplace (U.S. Department of Education, 2017).

**Purpose of Study and Research Questions.** The purpose of our study was to investigate Texas A&M University College of Agriculture and Life Sciences students' career-readiness and identify factors that influence their career-readiness. Four research questions guided the study:

1. What sources do students seek for career advice?
2. How do students reflect on their development of employability skills?
3. How do students participate in experiences relevant to their preferred career industry?
4. How have students developed the most since the start of their degree program?

## Method

**Context of Study.** As of fall 2021, the Texas A&M University College of Agriculture and Life Sciences enrolled 7,635 students studying in 15 academic departments that offer 79 undergraduate degree programs and majors (Texas A&M University Accountability, n.d.; Texas A&M University College of Agriculture and Life Sciences, n.d.). Academic programs in the College prioritize high-impact experiences that prepare students to gain technical expertise, think critically and creatively, solve problems, and communicate effectively (Texas A&M University Catalogs, n.d.). Although certain programs require students to complete an internship, undergraduate research, or study abroad (e.g., Department of Soil and Crop Sciences), all students are encouraged to participate in at least three high-impact experiences (Texas A&M University Catalogs, n.d.). They also have access to the College's study abroad programs and can join student organizations sponsored by the College, its individual departments, or the University, which is home to more than 1,000 organizations (Student Activities, n.d.; Texas A&M University Catalogs, n.d., para. 3). Therefore, we know that most, if not all students in our sample have either participated in high-impact experiences or been encouraged to do so. We do not know if students recognize or consider such experiences as high-impact, and we did not reference high-impact experiences during the interviews to avoid leading questions. In addition, all students "must pass two approved courses in their major that fulfill the graduation requirement for writing and oral communication" (University Writing Center, n.d., para. 1). They can choose to take one writing course and one communication course, or two writing courses (University Writing Center, n.d.). Finally, all students receive advising services from professional advisors who assist with course selection and career planning (Texas A&M University Catalogs, n.d.).

**Study Design.** We used a qualitative, phenomenological case study research design to answer our research questions. Phenomenology, a method often used in education research, seeks to make meaning of common, everyday lived experiences in rich, new ways (van Manen, 2017). In our study, we sought to understand the experiences

that contributed to agriculture students' career-readiness. Thus, career-readiness served as the phenomenon and the Texas A&M University College of Agriculture and Life Sciences served as the case in which we studied this phenomenon.

**Sample.** We chose to interview Texas A&M University College of Agriculture and Life Sciences juniors and seniors because they have likely started thinking about their career and can comprehensively reflect on their undergraduate experience (Corts et al., 2000; Kovar & Simonsen, 2019). Indicating their willingness to engage in future research, 71 juniors and seniors provided their emails at the end of a survey we distributed about developing employability skills. Using a modified version of Dillman et al.'s (2014) tailored survey design method, we contacted all 71 students through three rounds of email distributions. Despite using a $15 gift card incentive, we received a low response rate. Therefore, we sent one email recruiting all juniors and seniors in the College using Texas A&M University's bulk email service. We scheduled interviews with 19 students. Because of our dual sampling techniques, six students in our sample also responded to the survey, results from which are reported in a separate journal article (Parrella et al., 2023), and 13 did not. We were confident that we reached data saturation after interviewing 19 students because we recognized that we were not gathering new information from participants but rather hearing the same information (Guest et al., 2006).

Interview participants, 10 juniors and nine seniors, represented 10 of 15 departments in the College (see Table 1). Although all degrees offered in the College relate to agriculture, only 10 participants studied in degree programs that prepared them for technical agricultural careers. We did not find differences in the data between students studying in degree programs that prepared them for technical agricultural careers and those studying in other degree programs. Fourteen participants knew the type of career they wanted to pursue, three maybe knew, meaning they were able to articulate general career interests, and two did not know.

**Interview Protocol.** The interview protocol consisted of 18 questions divided into four sections—introductory, applied knowledge, effective relationships, and workplace skills (U.S. Department of Education, 2017; see Table 2). We developed questions that assessed students' skill development as it pertained to each of the three categories in the employability skills framework. The *applied knowledge* questions focused on decision making because employers in agriculture and natural resources considered it to be the second most important skill for student success (Crawford et al., 2011). The *workplace skills* questions included several communication-focused questions because employers in agriculture and natural resources considered communication to be the most important skill for student success (Crawford et al., 2011).

**Table 1**

*Academic Characteristics of Interview Participants (N = 19)*

| | Department | Major | Classification | Career Knowledge | Career Pursuit |
|---|---|---|---|---|---|
| P01 | Entomology | Forensic and Investigative Sciences | Junior | Yes | Medical examiner |
| P02 | Recreation, Park & Tourism Sciences (RPTS) | RPTS | Senior | Yes | Event planning |
| P03 | Animal science | Animal science | Junior | Yes | Veterinary school, non-profit, or social work |
| P04 | RPTS | RPTS | Junior | Yes | Event management |
| P05 | Agricultural Leadership, Education and Communications (ALEC) | Agricultural Leadership and Development; Agricultural Communications and Journalism (AGCJ) | Senior | Yes | Law school; Agricultural corporate attorney |
| P06 | Biochemistry and Biophysics (BCBP) | Biochemistry | Senior | Yes | Pharmacy school |
| P07 | Nutrition | Nutrition | Senior | Yes | Food representative in sales |
| P08 | Soil and Crop Sciences | Plant & Environmental Soil Science | Senior | Yes | Graduate school; Soil scientist |
| P09 | Horticulture Sciences | Horticulture | Junior | No | N/A |
| P10 | Rangeland, Wildlife and Fisheries Management (RWFM) | RWFM | Senior | Yes | Wildlife researcher |
| P11 | RWFM; Entomology | RWFM; Entomology | Junior | Yes | Graduate school; Environmental consulting |
| P12 | RWFM | RWFM | Junior | Maybe | Enjoys educating children and adults about ecological conservation |
| P13 | ALEC | AGCJ | Junior | Maybe | Interested in writing for an agricultural company |
| P14 | BCBP | Biochemistry; Genetics | Junior | Yes | Medical school; Cardiothoracic surgeon |
| P15 | BCBP | Genetics | Senior | Maybe | Interested in continuing to research biochemical pathways |
| P16 | Plant Pathology and Microbiology | Bioenvironmental Sciences | Junior | Yes | Graduate school; Carbon flux researcher |
| P17 | BCBP | Biochemistry | Senior | No | N/A |
| P18 | Entomology | Forensic and Investigative Sciences | Senior | Yes | Medical school |
| P19 | RWFM | RWFM | Junior | Yes | Wildlife biologist |

**Table 2**

*Semi-Structured Interview Protocol*

| Interview Questions |
|---|
| Introduction |
| Which department(s) do you study in? |
| What is your classification? |
| Do you know what type of career you want to pursue after you graduate? If so, what it is? |
| Applied Knowledge |
| Please describe your decision-making process. |
| When you think about decision-making, what are your strengths and your weaknesses? |
| Have you received any instruction (courses, assignments, particular faculty) during college that you see connected to improving your decision-making skills? |
| Are there any experiences, outside of classes, that have improved your decision-making skills? |
| Effective Relationships |
| From whom (or where) do you tend to seek career advice or opportunities? |
| Do you have professors with whom you will stay connected with after you graduate? If so, explain how you have developed a relationship with this/these individual(s). |
| Do you prefer to work independently or as a member of a team? |
| Describe your experience with teamwork during your degree program. |
| Describe your experience meeting or networking with professionals in your preferred career industry. |
| Workplace Skills |
| Describe yourself as a communicator. |
| Describe yourself as a science communicator. |
| When you think about communication, what are your strengths and your weaknesses? |
| What types of feedback have you received from professors during your degree program that has enabled you to improve your communication skills? |
| Describe work or internship experiences you have completed that are relevant to your preferred career industry. |
| Describe your personal growth from the beginning of your degree program to now. |

**Data Collection and Analysis Procedures.** We used a semi-structured approach to keep the interviews conversational in nature with the ability to clarify when necessary. We established a mutually convenient time to conduct the 19 interviews that averaged 45 minutes in length. One author conducted the interviews via Zoom over a three-week period (June 2–June 22, 2021). We recorded and transcribed each interview. Using the transcripts, we created units of data by separating participants' individual thoughts. Each unit was 1 to 3 lines of text in length. Once each transcript was divided into data units, we printed them and cut out the individual units. We analyzed the data using open coding

procedures, immersing ourselves in a unit-by-unit analysis, coding the data in different ways, and writing notes about the conceptual implications that emerged (Glaser, 1978). Persistent constant comparison led to emergent categories, which represented our themes. Our analysis revealed five themes—*Career Advice-Seeking Behavior*, *Employability Skills Development*, *Network Establishment*, *Relevant Experience Participation*, and *Personal Growth*. Three of the themes also had sub-themes (see Table 3). Some characteristics supporting each theme represented more than five students, but we included no more than five identifiers per characteristic in our findings for the sake of space.

**Table 3**

*Emergent Themes and their Sub-Themes*

| Theme | Sub-Theme |
|---|---|
| Career Advice-Seeking Behavior | |
| Employability Skills Development | Communication Skills |
| | Science Communication Skills |
| | Decision-Making Skills |
| | Life-Long Learning |
| | Teamwork Skills |
| Network Establishment | Academic Program Environment |
| | Interaction with Industry Professionals |
| | Professional Event Attendance/Organization Membership |
| | Rapport with Professors |
| Relevant Experiences | Undergraduate Research |
| | Work/Internship Involvement |
| Personal Growth | |

We achieved trustworthiness during our data collection and analysis procedures through credibility and transferability. To establish credibility, we used intercoder reliability. One author initially completed open coding, and two researchers who were not authors on the study, mimicked the same procedures to determine the extent to which each coder made the same coding decisions (Lombard et al., 2002). We also transcribed each interview verbatim to ensure accurate interpretations (Maxwell, 2013). To establish transferability and to help readers draw conclusions, we wrote in-depth descriptions of the emergent themes (Bryman, 2016).

**Limitations.** Our study has two primary limitations. First, our findings are not representative of students pursuing traditional technical careers in agriculture because the College offers diverse degree programs that also prepare students for careers outside of the industry. Still, our findings provide a glimpse into these students' career-readiness patterns. Second, using the researcher as the instrument presents a threat to the validity of

qualitative data due to personal bias. Three study authors teach agricultural social science to students in the population under study, and two authors teach agricultural science to students elsewhere. As agricultural educators, we acknowledge that our opinions regarding student development may be biased. We each hold beliefs about the extent to which our students have developed employability skills and the experiences and feedback that have contributed to their development. We implemented bracketing by setting aside our experiences that may influence data interpretations. It is difficult, though, to achieve bracketing entirely or state with complete confidence that our interpretations of the data are unbiased.

## Findings

**What Sources do Students Seek for Career Advice?** The *Career Advice-Seeking Behavior* theme answered research question one. Most students sought career advice from multiple sources with parents being the most common source of information for students (e.g., P03, P08, P12, P14, P17), but only two students had a parent who worked in their chosen industry (P04, P08). Others seek career advice from their parents for personal reasons (e.g., because they were supportive [P14], had similar college experiences [P13], had a lot of life experience [P02], and worked in education [P12]). In addition to parents, students sought career advice from graduate students (P06, P08, P10, P14, P15), whether that was teaching assistants (P08) or doctoral students working in a research capacity (P06, P10, P14, P15). Five students sought career advice from undergraduate or graduate advisors (P03, P08, P12, P15, P18), five from internet sources (e.g., LinkedIn; P01, P02, P04, P18, P19), four from professors in their department (P01, P06, P08, P10) or faculty serving as principal investigators on research projects (P10, P16), and three from industry professionals with whom they established rapport (P05, P16, P20). One student acknowledged University career counseling but never used it (P04), and one acknowledged College career fairs but never attended (P08).

**How do Students Reflect on their Employability Skills Development**? The *Employability Skills Development* theme, and its five sub-themes, answered research question two.

**Employability Skill Development.**

***Communication Skills***. More commonly, students described their communication skills in generic terms and phrases (see Table 4). Five students described themselves as "good" or "effective" communicators (P05, P06, P09, P11, P19), while others used thorough, respectful, purposeful, clear, confident, passionate, forthright, open, intentional, and expressive to describe themselves (e.g., P05, P07, P10, P14, P17). Also, students acknowledged the ability to actively listen, write concisely and thoroughly, sound professional, facilitate discussions, feel comfortable giving presentations, listen to understand, and maintain eye contact as communication strengths (e.g., P02, P04, P06, P10, P13). Students acknowledged their communication weaknesses as struggling to choose words, speaking publicly, speaking at an appropriate pace, speaking concisely,

listening actively, speaking at an appropriate volume, engaging an audience, and writing cohesively (e.g., P04, P06, P08, P11, P18).

**Table 4**

*Key Words and Phrases Students Used to Describe their Communication Skills*

| | Description of Communication Skills |
|---|---|
| P01 | Matured as a communicator; extrovert; enjoys talking to people; active listener |
| P02 | Thorough written communicator; not a bad oral communicator; difficulty deciding which words to use |
| P03 | Doesn't like conflict; people pleaser; communicates better one-on-one |
| P04 | Not a leader in communication; not a strong public speaker; struggles to communicate concisely; can sound professional; decent etiquette when writing emails |
| P05 | Really good communicator; no problem talking to people; respectful communicator; effective communicator; intimidating |
| P06 | Effective communicator; facilitates discussions well; active listener; tends to talk too fast |
| P07 | Very communicative; writes concisely; sometimes overcommunicates; never under-communicates; purposeful communicator |
| P08 | Clear communicator; open communicator; not a concise communicator; working to improve active listening skills |
| P09 | Good communicator; can talk to people; struggles to be concise |
| P10 | Confident communicator; comfortable giving presentations; enjoys writing |
| P11 | Good with communication; gets the point across; tends to stumble over words; hesitant to use volume |
| P12 | Improved at communicating through trial and error; talks too fast |
| P13 | Passionate communicator; turbulent communicator; listens to understand; commandeers conversations |
| P14 | Forthright communicator; people person; enjoys speaking in front of large crowds |
| P15 | Communicates thoughts and feelings openly; not afraid to ask questions; thoughts get jumbled; enjoys listening to people; experienced at giving presentations; maintains eye contact |
| P16 | Visual person; difficulty putting thoughts into words |
| P17 | Overly communicate; very good communicator; expresses feelings; intentional with words; speaks too fast |
| P18 | Shy; getting better at communicating; gets nervous talking in front of a group or giving presentations; blunt; not good at engaging an audience |
| P19 | Good communicator; above average communicator; likes talking to people; expressive; struggles to write concisely and cohesively |

In terms of feedback, nine students did not recall receiving communication-related feedback from their professors (e.g., P02, P03, P06, P12, P17) with the exception of P02 recalling that communication-related criteria was part of the evaluation rubric for a class presentation (e.g., do not look at presentation slides or notes for more than five seconds at a time). Others recalled receiving feedback on their oral communication skills

after delivering class presentations with feedback specifically being speak with confidence (P11), improve tone of voice (P19), practice more (P11), and defend a statement better (P11). Others recalled specific feedback related to writing improvement (P04, P07, P18, P19). For example, P07 learned how to critique scholarly writing and, as a result, improved their ability to write concisely and transparently. In addition, other students had a professor who taught them how to communicate effectively in a way that represents different viewpoints (P05), who discussed personal biases and how those influence communication (P08), and who explained the importance of using analogies to communicate science (P14). Outside of the formal classroom and through undergraduate research involvement, two students received feedback on their oral communication skills (e.g., speak with confidence, use less filler words, increase the visual appeal of presentation slides [P08], look at the screen/notes less, and clarify a concept [P15]).

***Science Communication Skills***. Most students used generic and oversimplified terms and phrases to describe their science communication skills (see Table 5). Only two participants used positive adjectives—passionate and elated—to describe themselves as science communicators (P08). Five students enjoyed science communication and recalled their perceived strengths (P01, P08, P11, P12, P14). Six students, however, did not say they enjoyed science communication and focused on their perceived weaknesses (e.g., P09, P10, P16, P17, P19) with four students more neutral in the practice of science communication (P04, P07, P15, P18). In terms of using science communication skills and strategies, nine students described using analogies (P14), understanding different perspectives (P01, P08, P12), avoiding technical jargon (P06, P08), providing evidence to substantiate claims (P04, P12), and maintaining transparency (P07), honesty (P11), and empathy (P12) as being important to the process. Interestingly, four students did not seem to consider their area of study a science (P02, P03, P05 P13). For example, P02 said, "if someone were to ask me what feed ratio to feed a show heifer, I would know that food science sort of thing. But I don't know if you would consider that science or not." P03, an animal science major, spoke more in the context of science communication: "I'm not a science communicator. There is nothing for me to communicate." Similarly, P05 admitted not knowing the definition of science communication: "I don't even really know what science communication is, to be honest."

**Table 5**

*Key Words and Phrases Students Used to Describe their Science Communication Skills*

| | Description of Science Communication Skills |
|---|---|
| P01 | Elated to talk about science with people; enjoys discussing new perspectives and theories; repeats what others say to understand them |
| P02 | Not sure what to consider science |
| P03 | Not a science communicator; nothing to communicate |
| P04 | Does research beforehand; sticks to what they are good at doing; backs information up with facts |
| P05 | Doesn't know what science communication is; often speaks in technical terms; communicates science naturally |

| | |
|---|---|
| P06 | Breaks down scientific language; doesn't always have the right words; struggles talking to scientists more than non-scientists |
| P07 | Black-and-white; to the point; transparent |
| P08 | Passionate science communicator; ability to gauge audience understanding; tends to use technical terms then re-explains using simplified language; tries not to oversimplify; views agricultural science from multiple perspectives; avoids feeling frustration; recognizes personal biases; understanding and approachable; needs to increase confidence; needs to better understand limitations of science |
| P09 | Not a very good science communicator; similar to learning a new language |
| P10 | Overuses technical jargon; working to find an appropriate balance with language use |
| P11 | Prioritizes mutual respect and honesty; withholds detail when it is not relevant to certain audiences; can keep atmosphere calm |
| P12 | Direct; to the point; views topics from multiple perspectives; provides facts, evidence, and interpretation; empathetic |
| P13 | Listens to understand; can understand better than disseminate |
| P14 | Uses analogies; truly knows the material if they can explain it to a seventh or eighth-grader; enjoys disseminating a complicated subject in an east-to-understand manner |
| P15 | Improving ability to deliver research presentations |
| P16 | Difficulty explaining science to non-scientists; asks in-depth questions to understand material |
| P17 | Not the best science communicator; doesn't know science language very well |
| P18 | Only communicates science for projects; prepares beforehand |
| P19 | Communicates well through science; needs to better understand science terminology |

***Decision-Making Skills.*** Students did not share a formal, universal decision-making process—indicating that they may not adhere to a specific process when making decisions (see Table 6). However, some students did have strategies for making decisions. For example, four students described their tendency to gather relevant information by conducting research (P05, P08, P09, P14), with eight identifying alternatives by creating a pro and cons list (e.g., P04, P06, P10, P12, P15), five weighing options (P02, P07, P10, P11, P18), and six contemplating the effects of their decisions (e.g., P05, P10, P12, P16, P17).

**Table 6**

*Key Words and Phrases Students Used to Describe their Decision-Making Process*

| | Description of Decision-Making Process |
|---|---|
| P01 | Evaluates circumstance; identifies external influencing factors; conducts cost-benefit analysis |
| P02 | Weighs all options; uses process of elimination; creates a pros and cons list |
| P03 | Seeks parental advice |
| P04 | Creates a pros and cons list; considers implications; better at making decisions while under pressure; considers different perspectives |
| P05 | Conducts research; considers implications; follows through |

| | |
|---|---|
| P06 | Creates a pros and cons list; seeks input from trusted sources |
| P07 | Weighs all options; considers priorities |
| P08 | Conducts research; seeks input from parents; creates pros and cons list |
| P09 | Conducts research; conducts cost-benefit analysis |
| P10 | Weighs all options; creates pros and cons list; considers priorities; considers people who may be affected |
| P11 | Weighs all options; creates pros and cons list |
| P12 | Considers implications; considers pros and cons; considers different perspectives |
| P13 | Does not act spontaneously; plans everything out |
| P14 | Aggregates data; Seeks input from trusted sources; considers different perspectives |
| P15 | Creates pros and cons list; considers priorities |
| P16 | Considers implications |
| P17 | Considers people who may be affected |
| P18 | Seeks parental advice; weighs all options |
| P19 | Does not act spontaneously; seeks balance |

Students identified several factors that strengthened their decision-making skills. Eight students credited certain courses or professors for helping them improve their decision-making skills (e.g., P04, P05, P11, P13, P19). For example, course exams and group projects impact students' skills (P02), professors can help them recognize that "every decision you make impacts things that you don't even realize" (P04), and certain assignments help improve decision making (P13). In addition, undergraduate research involvement (P09, P14, P15, P19) and work and internship experiences (P17, P18) help improve decision-making skills. For example, as the team research leader, a student is constantly "making decisions about creating a study, making decisions when it comes to IRB forms, [and] deciding who's going to be delegated what for each part of the study" (P14). Furthermore, a student can use research labs as a "collaborative space to make decisions about experiments" (P15). Two students (P06, P16) could not recall specific experiences that strengthened their decision-making skills.

***Life-Long Learning***. Five students expressed a desire to engage life-long learning (P01, P06, P08, P11, P13). For example, P11 described their passion as ever growing—"My passion keeps growing. The more I learn, the more I want to learn, the more I want to do." The hunger for knowledge was fuel to the fire of learning for another student. "I'm still obviously a developing scientist, but I just feel like I've gained so much knowledge and I never want to stop" (P08). P13 considered the desire for life-long learning as a strength when thinking about improving communication skills.

***Teamwork Skills***. Seven students preferred to work independently (e.g., P03, P06, P09, P11, P17). Working independently brings "peace of mind" because "it's a lot easier to just take care of yourself" and not "be in charge of anyone else" (P09). Interestingly, P06 preferred to work independently not because of bad experiences but because of motivation and productivity: "It's not even that I've had bad experiences with teamwork. I just know my schedule and where my motivation is, and I have no control over other people." Eight students' preferences depended on the task at hand (e.g., P01, P05, P08, P13, P18) with three students preferring to work as a team (P14, P15, P19).

Furthermore, we asked students to share their experiences working in teams during their degree program, but we did not specify the context (e.g., in class, outside of class). Nine students initially associated teamwork with a negative group project experience in class (e.g., P02, P10, P11, P17, P18). For example, "I hate team projects for class, unless I get that good group. That only happened once, and it was a miracle" (P08). One reason groups are challenging is because "it's hard to communicate and harder to organize" (P11). In opposition, six students shared only positive teamwork experiences in class (e.g., P04, P05, P06, P07, P13) and 10 shared only positive teamwork experiences as part of relevant work and internship experiences (P02, P13, P16) or undergraduate research involvement (e.g., P10, P11, P15, P16, P19). Students shared only positive experiences with teamwork in the context of work, internship, or research involvement. Students noted that an important piece to making teamwork successful is hearing multiple and diverse perspectives (e.g., P01, P05, P07, P12, P18): "Collaborating with people who think differently than you is really eye-opening and encouraging" (P05).

### How do Students Participate in Experiences Relevant to their Preferred Career Industry?

The *Network Establishment* theme had four sub-themes and the *Relevant Experiences* theme had two sub-themes. Together, these themes answered our third research question.

#### Network Establishment.

***Academic Program Environment.*** Six students suggested that the size or nature of the department or field in which they study impacted their career-readiness (e.g., P07, P11, P12, P13, P16). For some, it was the size and friendliness of the department (P07, P12)—"everyone is so willing to help each other; it's like a little family." One professor told students "Look around the classroom. Because this field is so small, you will run into at least two or three of these people again in your career. These are the people you need to network with and get to know" (P12). Students also believed small departments were helpful, but one student (P13) described the Department of Agricultural Leadership, Education and Communications—one of the larger departments in the College—as "one big happy family who will always help each other."

***Interaction with Industry Professionals.*** Seventeen students said they had opportunities to interact with professionals in their preferred career industry (e.g., P01, P03, P07, P12, P17) because professors' host industry professionals as guest speakers and students interact with industry professionals as part of course assignments. For example, P05 described an assignment that required students to interact with industry professionals that ended in being offered an internship. Students also found that networking opportunities with industry professionals surfaced through their internship (P02, P03, P17) and through volunteer work (P11). Students connected with industry professionals through social media (P04, P08) and through conference attendance resulting from their undergraduate research or professional organization involvement (P08, P10, P12, P16, P18). Yet, two students said that they had not met or interacted with industry professionals during their college careers (P06, P09).

***Professional Event Attendance/Organization Membership.*** Seven students attended professional events or were active members of professional organizations (e.g., P08, P10, P12, P16, P18). Such events included University-sponsored professional workshops focused on career preparation (e.g., writing workshops, résumé development), annual meetings hosted by professional societies, and regional chapter meetings. Attending professional and chapter meetings provided rich opportunities to "network with grad schools" (P08), see people who they met during internships (P08), and learn about "job opportunities in academia and industry" (P12). An important networking opportunity for undergraduates involved in research is attending research conferences because they can meet and connect with leaders in their discipline (P10, P15, P16). Two students had presented at research conferences (P10, P16), which they believed was valuable because they would "be recognized by people with similar interests" (P10).

***Rapport with Professors***. Twelve students planned to stay in contact with at least one of their professors through regular updates and for references (e.g., P07, P11, P13, P15, P19) and/or with the principal investigator of the project for their undergraduate research (P08, P10, P12, P16). P08 noted, "keeping up with those contacts is so important. Not only do they expand my network, but they are also huge network resources because they have relationships all across the discipline." In opposition, seven students said they would not maintain contact with any professors (e.g., P01, P04, P06, P17, P18). P09 said, "the connection is temporary," and one P03 said, "I have not talked to professors one-on-one."

**Relevant Experiences.**

***Undergraduate Research***. Twelve students were involved in undergraduate research, which they associated with their development of various employability skills (e.g., P01, P08, P12, P14, P19). Undergraduate research was a common experience for many undergraduates studying biochemistry and genetics (P06, P14, P15, P17). Although two students (P06, P17) reported developing "critical thinking skills and improved their experiences working as a responsible team member," they had no desire to continue conducting research. Students conceptualized the undergraduate research experience as teaching them how to "work really well together as an interdisciplinary team," "view thinking processes differently," think for themselves, and make decisions (P08, P14, P15, P19). The hands-on experience they gained working in the lab reinforced their knowledge, made them a "stronger than average student" (P08), and helped them become more "independent, efficient, and responsible" (P15).

***Work/Internship Involvement.*** Twelve students had completed at least one relevant work or internship experience related to their anticipated career (e.g., P03, P04, P07, P12, P16). For example, students interested in event planning (P02, P04) had worked at a party rentals company and as a fundraising coordinator for a non-profit. Students had varying interests and gained experience through a variety of outlets, including an internship with an international agricultural law firm (P05), as a kitchen assistant at a children's center (P07), and an internship that required them to provide hospice care for dementia patients (P14). Relevant work or internship experiences helped students confirm their career goals and interests (e.g., P01, P02, P04, P11, P16) or

confirm that a specific career was not for them (P13). Five students who had identified their career interests had not participated in work or internship experiences relevant to their career goals (P06, P08, P11, P18, P19), and six had participated in undergraduate research (e.g., P08, P09, P11, P17, P19), which could turn out to be relevant work experience for those interested in attending graduate school (P08, P11).

### How Have Students Developed the Most Since the Start of Their Degree Program?

The *Personal Growth* theme answered research question four. Students reflected on their personal growth in their degree program and identified 15 areas in which they experienced development: confidence (e.g., P03, P07, P09, P10, P19); discipline-specific knowledge (P04, P06, P08, P11, P16); decision making (P03, P12, P14); recognizing personal potential (P10, P17, P05); responsibility (P09, P15); life balance (P07, P10); understanding different perspectives (P12, P16); time management (P02); passion (P11); working hard (P13); professionalism (P15); developing strong relationships (P16); positivity (P17); strategies for success (P18); and communication (P18).

## Conclusions, Discussion, and Recommendations

### What Sources do Students Seek for Career Advice?

Texas A&M University College of Agriculture and Life Sciences students' tended to seek career advice from parents, graduate students, professors, advisors, Internet sources, and industry professionals. They did not take advantage of University resources (e.g., career center) or College events (e.g., career fairs) to help with career preparation. Perhaps students are unaware of these resources or do not find them helpful. We recommend educators promote career preparation resources and events to their students, regardless of classification (e.g., freshman, senior), and scholars conduct future research to investigate why students, especially those nearing graduation, do not take advantage of such opportunities. It is also important to note that parents of first-generation students may find it difficult to provide their children advice about career preparation, should they be used as a resource. Because students tend to seek career advice from their parents, school administration should consider facilitating a workshop for parents of first-generation students interested in pursuing a degree, or a career, in agriculture so that they can better support their children as they navigate career planning and choices.

### How do Students Reflect on their Development of Employability Skills?

Students in our sample need their general communication skills further developed to improve their workplace skills (U.S. Department of Education, 2017). For the most part, students did not demonstrate an understanding of communication nuances and described themselves as communicators using generic terms or phrases. However, they mentioned several practices associated with effective communication (e.g., active listening, public speaking, writing etiquette, concise writing, speaking tone and pace, eye contact, audience engagement) that Crawford et al. (2011) also identified. Many students also described themselves as communicators using positive adjectives (e.g., thorough,

purposeful, confident, passionate), suggesting they perceive their skills to be well developed, just as Norris et al. (2019) and Parrella et al. (2023) found. Most students identified communication strengths and weaknesses, indicating they are capable of improving these particular workplace skills if they network, interact with industry professionals, work with teams, manage people, hold membership in a professional organization, and observe effective and ineffective communicators (Edmonds et al., 2016).

Students' science communication skills were also underdeveloped. Most students used generic and oversimplified terms and phrases to describe themselves as science communicators, indicating they lack knowledge about science communication intricacies and nuances. Few students used positive adjectives to describe themselves as science communicators, suggesting they do not perceive these skills to be as well developed as their general communication skills. In addition, students who indicated they enjoyed science communication shared perceived strengths and students who did not directly indicate they enjoyed it shared perceived weaknesses, suggesting they lack awareness and knowledge. However, some students addressed at least one practice associated with effective science communication, which suggests a foundational knowledge about science communication and how it differs from general communication. Science communication skills coincide with applied knowledge, effective relationships, and workplace skills in the framework because they require knowledge of scientific principles/procedures (applied knowledge), the ability to negotiate to resolve conflict and respect individual differences (effective relationships), and the ability to communicate verbally, listen actively, and convey information in writing (workplace skills) (U.S. Department of Education, 2017). Thus, well-developed science communication skills are essential to agriculture students' career success.

We find it problematic that several students did not consider their area of study to be science. Educators should emphasize how agriculture is science and should also incorporate general communication and science communication skills training into their course content (Parrella et al., 2022). Such integration can occur by requiring students to demonstrate these skills in their assignments and discussing the importance of these skills during lectures. Efforts toward developing agriculture students' general communication and science communication skills could improve their applied knowledge, effective relationships, and workplace skills (U.S. Department of Education, 2017). If educators are not confident in providing students adequate training, they should rely on experts by adopting context-specific science communication curriculum (Leggette, 2017–2020, 2019–2022) or inviting them to speak to their class(es).

Despite students' inability to share a formal decision-making process, many described their tendencies to conduct research, identify alternative options, and contemplate the effects of their decisions, which are consistent with competencies identified by Crawford et al. (2011). Students in our sample believed their decision-making skills (applied knowledge) improved through their professors, coursework, research experience, or relevant work/internship experiences (U.S. Department of Education, 2017). Furthermore, students in our sample mostly shared negative experiences related to teamwork during their courses but positive experiences with

teamwork during other relevant undertakings (e.g., internships, research). This could be because, when outside of class, students are among others who enjoy the work at hand. Therefore, providing students with more autonomy during classroom-based teamwork experiences or grouping students based on shared interests might improve students' perceptions and skills related to teamwork, which is important because teamwork experiences can significantly increase agriculture students' perceived development of employability skills (Parrella et al., 2023). Students' antipathy toward working in teams could stem from their lack of teamwork skills, which are a component of effective relationships (U.S. Department of Education, 2017). We recommend scholars conduct quasi-experimental research to determine if students who receive teamwork skills training perform better and experience more enjoyment compared to students who do not receive training.

Students' underdeveloped employability skills highlight the need for agriculture teachers to begin intentionally training students with such skills during high school. However, traditional agricultural curriculum, which focuses on developing industry-specific knowledge and skills, cannot effectively equip students with employability skills. One way educators can achieve simultaneous development of industry-specific knowledge and skills and employability skills is by implementing Leggette's (2017–2020, 2019–2022) interdisciplinary curriculum intended for secondary agriculture teachers that focuses on developing students' communication and decision-making skills in the animal, poultry, and plant sciences. By using this curriculum, high school students will be better prepared before entering college and continue developing employability skills during their degree program.

### How do Students Participate in Experiences Relevant to their Preferred Career Industry?

Most students in our study interacted with industry professionals through their classes, internships, social media, research conference attendance, or professional organization involvement, which directly aligns with the literature and demonstrates students' initiative and ambition related to career-readiness. For example, students in Feldpausch et al.'s (2019) sample deemed professional networking as very important to their career success, and students in Edmonds et al.'s (2016) sample believed such interactions improved their communication skills. Students in our sample interacted with industry professionals positively and regularly, suggesting the experience improved their communication skills, or workplace skills, and perhaps their science communication skills, resulting in applied knowledge, effective relationships, and workplace skills development (U.S. Department of Education, 2017).

Students in our sample benefited from attending professional events and being members of professional organizations. Some students learned about job opportunities, and others improved their leadership skills by holding a leadership position or their communication skills by presenting at research conferences. Comparably, Kovar and Simonsen (2019) and Truax (2020) found that collegiate club involvement improved agriculture students' employability skills (e.g., active initiative, social competence, leadership). Attending professional events and being members of professional

organizations prepared Texas A&M University College of Agriculture and Life Sciences students to achieve career success by developing their effective relationships (e.g., leadership) and workplace skills (e.g., communication; U.S. Department of Education, 2017), just as it did for Purdue University College of Agriculture students (Feldpausch et al., 2019). Because few students in our sample were members of professional organizations, we recommend educators promote more professional association involvement among undergraduate students.

In addition, many students recognized the value of developing faculty relationships and indicated that faculty contributed to their academic success, most likely by developing their effective relationships and workplace skills (U.S. Department of Education, 2017). Several intended to maintain connections with faculty to establish broader networks in their respective disciplines. These findings reflect those of Phelps (2020), Davis, (2021), and Strayhorn (2012). A few students believed that studying in a smaller department improved their ability to identify relevant internships, seek support, or network. Thus, programs should host student orientations to help students meet faculty and help those, especially in larger departments, navigate and obtain the same opportunities students in smaller departments experience (Strayhorn, 2012).

Furthermore, the importance of undergraduate research programs cannot be overstated. Students who participated in undergraduate research noted the experience contributed to their development of critical thinking, independence, and decision-making skills, which echoes Hamilton et al.'s (2013) findings. Students believed such experiences improved their responsibility skills (Marsh et al., 2016) as well as their teamwork and efficiency skills. Research experience further provided them opportunities to apply classroom knowledge and receive communication skills feedback. Therefore, participating in undergraduate research opportunities helped prepare students for career success by developing their applied knowledge (e.g., critical thinking skills, decision-making skills), effective relationships (e.g., teamwork skills, ability to demonstrate responsibility), and workplace skills (e.g., communication skills) (U.S. Department of Education, 2017). Although most students in our sample participated in undergraduate research, none participated who were studying agricultural social sciences. Faculty in these disciplines should encourage students to participate in research and provide opportunities for involvement. Future research should investigate the barriers hindering some students' participation in undergraduate research and devise strategies to help them overcome these barriers.

It would be beneficial for students to begin participating in high-impact experiences early on in their degree program, especially because they often help students navigate their career interests. High school students soon to join the university, and freshman new to the university, should be told how to identify opportunities to participate in professional organizations and undergraduate research, how to interact with industry professionals, and how to develop relationships with faculty. By starting earlier rather than later, students can gain additional and long-term exposure to high-impact experiences and have more time and opportunities to develop employability skills. It is important to note, however, that many high-impact experiences are geared toward upper-

level students. University organizations and programs should be intentional about ensuring opportunities for freshmen exist and that those opportunities are promoted.

**How have Students Developed the Most since the Start of their Degree Program?**

Students' most common areas of perceived personal growth reflected employability skills. They mostly experienced growth in the areas of effective relationships (e.g., understanding different perspectives, responsibility, professionalism, developing strong relationships, recognizing personal potential, positivity) and workplace skills (e.g., time management, life balance, strategies for success, communication) (U.S. Department of Education, 2017). We recommend future researchers conduct a longitudinal study using a pretest-posttest research design to measure cohorts of agriculture students' growth in these areas between the start and finish of their degree program. It would also be beneficial to use a repeated measures design and assess students' skill development three or more times over the course their degree program (e.g., start of freshmen year, end of sophomore year, end of senior year). That way, we can begin to understand how students perceive their skill development after completing certain program milestones.

We gained deeper insight into Texas A&M University College of Agriculture and Life Sciences students' career advice-seeking behaviors, development of employability skills, networks, experiences, and personal growth. Our findings have direct implications for revamping instruction and curriculum through the lens of career-readiness. Similar research should be conducted at other land-grant universities so that comparisons can be made. By understanding the competencies and experiences of students nearing the end of their degree programs, we can develop and implement, on a larger scale, programmatic and instructional strategies intended to improve students' career-readiness and develop a proficient agricultural workforce.

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