CSSA PRESIDENT'S MESSAGE

Mentoring: A Foundation of Scientific and Professional Success

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When I meet friends from graduate school at the ASA, CSSA, and SSSA Annual Meetings, we often reflect that while we thought our major career accomplishments would be our scientific discoveries, we are most proud of students and colleagues whom we have mentored and guided. We also value more greatly those who mentored us. Speakers remembering Dr. Ron Phillips at the 2023 Ron Phillips Plant Genetics Lectureship described his fish fries and his guidance and friendship lasting well into their careers. I think often of my own graduate advisers and mentors, Dr. Tommy Carter and Dr. Earl Wernsman. In fact, mentoring is critical to the scientific process as we observe previous work, develop new questions, research, report findings, and rely on others to continue the discovery.

The Societies provide several opportunities for members to connect. Formal mentoring programs include the Golden Opportunity (GO) Scholars, Greenfield Scholars, and Bridge Scholars. Our committee and leadership structure enables mentorship by rotating new, current, and past leadership over three-year terms. Informal mentoring relationships exist between experienced and newer members in divisions, communities, and specialty groups. However, these programs are somewhat diffuse and uneven in quality. These programs do not have the capacity currently to educate and train members about mentoring.

Given that mentoring is a foundation of scientific and professional success, The National Academy of Sciences convened a workshop on "Effective Mentoring in STEMM (Science, Technology, Engineering, Mathematics, and Medicine)" in 2017 (NAS, 2017). Participants emphasized that mentoring is an interactive mutual relationship rather than a hierarchical one. Mentoring relationships take several forms and are often most effective as a network of colleagues, peers, co-workers, and sponsors, rather than a single graduate adviser. For example, the 2023 GO Scholars benefitted from traditional one-on-one mentoring that was part of the program; GO Scholars also requested additional interaction with, and mentoring from, current graduate student members.

The term "mentor" was first used in English language around 1750, meaning one who counsels, guides, advises, and enables. Attributed to *Les Adventures de Telemaque* by the French author Fenelon in 1699, Mentor was wise and caring. In *The Odyssey*, from which *Telemaque* was derived, Mentor was an old

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Illustration by Pablo E. Fabisch for *Les Adventures de Telemaque,* depicting Telemachus and Mentor. Public domain image courtesy of Wikimedia Commons.

friend of Odysseus who was entrusted to take care of his household and advise his son, Telemachus. However, when Odysseus returns, he discovers that his household has been overrun, his money spent, and his son bullied, indicating that the original Mentor needed additional training and support (Roberts, 1999). Clearly, and as we have all experienced, some mentoring relationships are more helpful than others.

Effective mentoring has a profound impact on an individual's growth and development, providing the guidance and support needed to thrive in a chosen career and avoid the problems of Odysseus. Research has shown that graduate students are more likely to persist in their academic decisions, complete their degree, and to publish their research if engaged in positive mentoring experiences. Also, recruitment of women and under-represented students into the STEMM academic community, graduate school, and research-related career paths increases if they are engaged in positive mentoring experiences (NAS, 2019). The National Academy of Sciences has a variety of training opportunities for mentors and mentees that were developed from the 2017 workshop and others, including a series of excellent podcasts: https://bit.ly/48BcHb4.

"Mentorship is a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support."

—National Academy of Sciences, Engineering, and Medicine, 2019

Survey Says...Mentoring Is a High Priority for Members

For the Societies, results from the "Future of Membership" survey and the "Diversity, Equality and Inclusion" (DEI) surveys conducted by ASA, CSSA, and SSSA in 2021 both clearly pointed to mentorship as a high priority with 85% of participants supporting the development of a mentoring program for the Societies.

Mentoring was rated in the top three focus areas for the Societies, along with Professional Conduct/Anti-Harassment Policy Development and Education/Training. Survey results suggested that the Societies were not viewed as providing programs and resources that fostered success of under-represented groups in our membership, particularly with students and early career members. Therefore, there is need to build on the existing mentoring programs and services for all Society members, and especially for under-represented groups in our sciences and Societies.

Developing a Robust Mentoring Program Within the Societies

Given the importance of mentoring to our membership, recognition that mentoring relationships are the most valuable part of our work, and research supporting the favorable outcomes from effective mentoring, the "DEI Recommendations Report" calls for "the assessment, funding, and development of a robust mentoring

The Societies provide several opportunities for members to connect. Formal mentoring programs include the Golden Opportunity Scholars, Greenfield Scholars, and Bridge Scholars.

program that connects members with mentors—regardless of career stage—within and across—Societies." The Mentoring Working Group of the ASA, CSSA, and SSSA Diversity, Equity, and Inclusion Committee (DEIC) was formed to develop and review potential mentoring programs for members. The goal of the working group is to identify a mentoring program that provides mentor and mentee training, establishes clear goals and expectations, matches mentors and mentees carefully, encourages open communication, establishes meeting schedules, and provides ongoing support to mentors and mentees.

As part of the working group's assessment of a mentoring program, additional research was conducted through a survey focused on mentoring in the spring of 2023. In summary,

- **91% of undergrads, 93% of graduate students, 97% of early career members, and 78% (averaged) of mid/late/retired members are interested in being a mentee, mentor, or both.**
- **More than 65% are interested in both traditional 1:1 and peer-to-peer mentoring, and approximately 40% are interested in group-based, learning circles, and event-based mentoring.**
- **More than 60% would participate if mentor/mentee training was a prerequisite.**
- **38% of participants would be willing to support the program with a small optional contribution.**

Ways You Can Advance This Strategic Plan Goal

Effective mentoring is a major component of our CSSA strategic plan goal to "Set our members up for advantages throughout their careers with ongoing professional development." Some practical ways you can advance this goal in your career include:

- **Participate in fostering robust mentoring programs in the Societies.**
- **Nominate talented undergraduates as a GO, Greenfield, or Bridge Scholar.**
- **Volunteer to be a mentor in those programs.**
- **Contribute to the mentoring programs through the Agronomic Science Foundation.**
- **Participate in mentor training opportunities.**
- **Practice mentoring in your institution.**

Members of all ages and years of service can participate to develop career resources to keep students in STEMM and attract students to our science and create opportunities for success throughout member careers. If mentoring made a difference in your career, you might find you greatest lasting impacts are paying it forward and mentoring others.

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Roberts, A. (1999). The origins of the term mentor. *History of Education Society Bulletin*, *64*, 313–329.

As members of ASA, CSSA, and SSSA, it is in the best interest of our scientific community to shape mentor–mentee relationships effectively and to see that all individuals feel they are supported in achieving goals and advancing the field. Photo courtesy of Adobe Stock/Tinashe N.

STUDENTS

Approaching Effective Mentorship Both as a Mentor and Mentee

| **By** Andrea Basche, Associate Professor, University of Nebraska–Lincoln, Department of Agronomy and Horticulture; Fernanda Souza Krupek, Assistant Professor, Ohio State University, Department of Horticulture and Crop Science; and Om Prakash Ghimire, Graduate Research Assistant, Clemson University, Department of Plant and Environmental Sciences

Mentoring is a hands-on form of career development. Effectively using mentoring as a career growth tool can lead to important outcomes such as degree completion (Lovitts, 2008), increased self-efficacy (Paglis & Bauer, 2006), satisfaction with educational experiences (Gardner, 2009), and retention of students and faculty, especially for those who may be underrepresented or marginalized (Zambrana et al., 2015; Kricorian et al., 2020; Grunwald & Daroub, 2023), just to name a few.

Throughout our professional careers, we serve in positions of both mentor and mentee—providing as well

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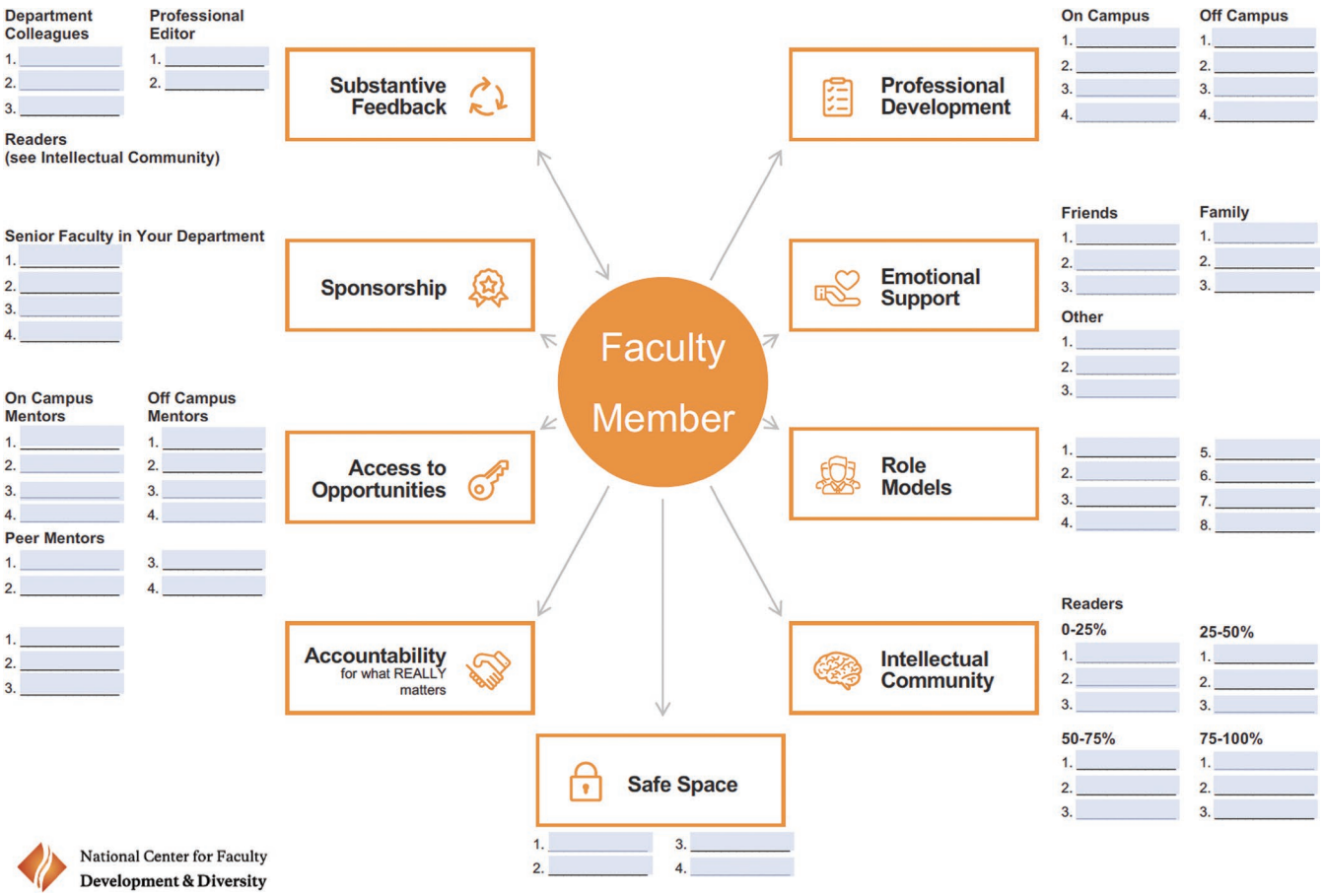

Figure 1 This mentor map, developed by the National Center for Faculty Development and Diversity, offers a great opportunity to map your mentoring network, identify your unmet needs, and plan how to expand your existing network. See https://www.facultydiversity.org/ncfddmentormap for instructions on how to fill it out.

as seeking support for a range of topics from career (e.g., sponsorship, coaching, and protection) to psychosocial development (e.g., support, role modeling, and counseling) (Johnson & Huwe, 2003).

As members of ASA, CSSA, and SSSA, it is in the best interest of our scientific community to shape mentor–mentee relationships effectively and to see that all individuals feel they are supported in achieving goals and advancing the field (Vaughan et al., 2019). Through our shared experiences, we offer insights on how to navigate mentor–mentee relationships. Based on our experiences as students and early career faculty, we focus on strategies that faculty or others in team leadership positions, postdocs, and graduate students can use, which include but are not limited to (1) assessing your needs, (2) maintaining effective communication, and (3) aligning expectations.

1. Assessing Your Needs

Self-assessing your needs as a professional is the first step towards cultivating strong and authentic mentoring relationships. Figure 1 offers a great visual to "map" your mentoring network, identify your unmet needs, and plan how to expand your existing network. You may want to consult https://www.facultydiversity.org/ncfddmentormap for additional instructions on how to fill out this mentor map. Although initially designed for faculty members, the map can be easily adapted to your current needs, depending on your goals and where you are in your career path as a faculty member, graduate student, or postdoctoral fellow.

Advice for Faculty, Team Leads, or Mentors

Self-assessing needs is critical both for mentors and mentees. We recognize that no one will do this deep reflection for us. It is contingent upon ourselves to discover what we need and when as needs are surely to evolve throughout stages of a graduate program or career. An unfortunate reality is that many of us are overcommitted without the capacity to consider what others need and perhaps not even what we need ourselves. Encouraging mentees to reflect on and communicate their needs is a valuable step. Relatedly, if mentorship truly matters to you, prioritize it! Make a

The Graduate Student Networking Session and other programming available at the ASA, CSSA, and SSSA Annual Meeting can help you engage with professionals as well as establish meaningful career/lifelong connections. Photo courtesy of Remsberg.

conscious effort to prioritize who you want to be as a mentor from the beginning of a position.

Advice for Postdocs, Graduate Students, or Mentees

Your adviser can be a key mentor, but as the mentor map indicates, it is wise to cultivate a variety of mentors, which may include other faculty, peers, university administrators, and professional societies (Barnes et al., 2021).

You might ask yourself questions such as "What are the skills I hope to gain in this role/project?" "What are my strengths and weaknesses in areas such as problem-solving aptitude, time and budget management, independent thought process, manuscript and grant writing, data analysis, and leadership skills for which I may require mentorship?" And "What are my current needs and life/career goals?" Reflecting on these questions is important—you should not expect that someone will be ready to anticipate all of your needs and hopes. Being successful requires at times deep reflection!

Professional associations, at local, national, and international levels, are also a great opportunity to broaden and expand the scope of potential mentors that could meet your needs and goals. For example, the Graduate Student Networking Session and other programming available at the ASA, CSSA, and SSSA Annual Meeting can help you engage with professionals as well as establish meaningful career/lifelong connections.

2. Maintaining Effective Communication

Similar to teaching, mentoring involves the exchange of information and experiences between people. Learning how to communicate with each other can increase the likelihood that both mentors and mentees are open to sharing ideas, accomplishments, and challenges they are experiencing. Additionally, mentors and their mentees may or may not come from similar walks of life, so learning how to communicate and establish a relationship across differences is important to ensure equitable access to the beneficial outcomes of mentoring.

Advice for Faculty, Team Leads or Mentors

It can pay dividends to consider and design systems for communication with mentees. This might include intentionality around the frequency of meetings, a process for how meetings will proceed, and more. While some communication might happen organically, intentionally designing space and time for communication benefits both mentor and mentee. In particular, it allows space for building trust in order to navigate conflict or more challenging periods.

Advice for Postdocs, Graduate Students, or Mentees

Be specific and clear on your asks—feedback on your writing, advice on how to handle a conflict, suggestions for course or professional development opportunities, requests of a recommendation letter, vacation leave, conference attendance, or any other needs. The more specific you are, the more you benefit from the support your mentor can provide.

Make mentor–mentee meetings matter. This is particularly crucial to interactions with advisers and reflections on how to turn meetings from status updates to remarkable and meaningful conversations. It is

important that you take ownership of every meeting attended, reflecting on your role in the conversation as well as post-meeting action items. Here are some strategies that have worked well for us:

1. **sharing a suggested meeting agenda, either prior to or right before the meeting, shows that you are a serious, organized, and productive scholar who is committed and respectful for each other's time;**
2. **taking notes during the meeting and archiving meeting minutes in a sharable doc as well as a follow-up email or message with the main points discussed can also help summarize the key points of the conversation; and**
3. **sharing records and tracking of project/program progress through weekly updates (via email or shared Google Docs) or web-based platforms such as Trello can help to keep everyone on the same page.**

Seek opportunities to improve your communication skills. Mentoring undergraduate students and visiting scholars in your team, either formally or informally, can be an effective way to assess and learn how to approach best practices in communication as well as understand the situation through both mentor (now you!) and mentee (student support) lenses.

3. Aligning Expectations

One aspect of mentoring involves empowering mentees to unleash their potential—inside and beyond academic settings. Building on the other suggestions, dedicated time to discuss and align clear goals and expectations from everything large (i.e., timing for graduation, post-graduation goals, and thesis or dissertation chapter deadlines) and small (i.e., professional development experiences sought) in a program or role can be helpful for anchoring those relationships. We feel this is related to but distinct from both assessing needs and effective communication.

Advice for Faculty, Team Leads or Mentors

A few questions to consider might include: What systems are in place (i.e., regular check-in meetings or conference presentations) to check in on expectations and progress? Are you communicating clearly about expectations from the start of a position or program with your mentees? If not, what might be adjusted?

Advice for Postdocs, Graduate Students, or Mentees

Understand that you are not alone. While seeking support from a mentor, remember that they are also human beings with their own needs and goals (and who are most likely navigating other mentees' needs and requests). Thus, to navigate those relationships, it's important to be reasonable in your requests and reflect on questions such as, "Is this an appropriate time window to work with?" And "Is my request aligned with individual skills and capacity?"

Suggest an individual development plan (IDP) to discuss with your mentor short- and long-term goals and activities to reach those goals. Some universities and programs provide specific IDP templates that mentors and their mentees could use while online tools like MyIDP (https://myidp.sciencecareers.org) are also available. Including the scope and limitations of your projects as part of your IDP can also help identify what realistically can be accomplished in your program as well as possible new projects and extracurricular opportunities to fill your skills gaps.

Understand that the real life/career journey is a bumpy road. Challenges such as a rejected paper, changes in suitable days for fieldwork, or anticipated/delayed graduation plans affecting post-graduation job opportunities require us to reassess our plans periodically. At this point, it's incredibly important to pause and assess your progress. This is an opportunity for you to evaluate the effectiveness of your work/life habits (writing, data collection, class attendance, care for your physical and mental health, and so on). Whenever reassessing your plans, using SMART goals (Specific, Measurable, Achievable, Relevant, and Time-Bound) can help effectively discuss and align mentor–mentee expectations regarding your project/degree/program goals.

4. Effective Mentoring Practices—If Not Now, When?

The need not only for more agricultural professionals in general, but particularly for those underrepresented or marginalized in the past should lead us as a community to recommit efforts, with increased urgency, to how we assess, value, and implement effective mentoring practices (APLU, 2022). As we reflect on what mentorship has done for us at each turning point in our careers, there is much to be thankful for. We hope the thoughts and resources shared here help you to move from a reactive to a proactive stance—where you feel empowered to

Whenever reassessing your plans, using SMART goals (Specific, Measurable, Achievable, Relevant, and Time-Bound) can help effectively discuss and align mentor–mentee expectations regarding your project/degree/program goals. Image courtesy of Adobe Stock/rayoo.

initiate contact, ask for what you need, and focus the interactions on what matters. Moving forward in this way will help you feel more connected to instrumental people in your department and institution, open networks of opportunities, and solidify your professional relationships.

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CONNECT WITH US!

If you would like to give us feedback on our work or want to volunteer to join the ACS Graduate Student Committee to help plan any of our activities, please reach out to Maria Teresa (mariateresa.tancredi@uga.edu), the 2023 chair of the committee!

If you would like to stay up to date with our committee, learn more about our work, contribute to one of our *CSA News* magazine articles or suggest activities you would like us to promote, watch your emails, connect with us on Twitter (@ACSGradStudents) and Facebook (ACS.gradstudents), or visit: agronomy.org/membership/committees/view/ACS238/members, crops.org/membership/committees/view/ACS238/members, or soils.org/membership/committees/view/ACS238/members.

If you are attending the 2023 ASA, CSSA, and SSSA (ACS) Annual Meeting in St. Louis, don't forget to check out the workshop, tour, and special sessions organized by our ACS Graduate Student Committee and come meet us at our in-person meeting—look for the Graduate Student Committee Meeting on the agenda!

ASA PRESIDENT'S MESSAGE

Growing Your Professional Network

By Joann Whalen,
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Greetings! This month, I am pleased to give you an update on our forthcoming 2023 ASA, CSSA, and SSSA International Annual Meeting "Open Science Inspires," from Oct. 29 to Nov. 1, 2023 in St. Louis, MO and with a limited virtual meeting (acsmeetings.org). We received about 15% more voluntary abstract submissions this year than last year, which is great! I expect that our Annual Meeting will be a vibrant, exciting gathering of agronomic, crop, and soil science from across the United States together with our international attendees.

The ASA Annual Meeting, held in conjunction with the CSSA and SSSA Annual Meetings, is an outstanding opportunity for us to connect with each other and make new scientific friends. Engaging with your peers to get their recognition and support of your work is called professional networking. But what do we really mean by "networking"? If you already have a social media presence, do you need to work on your "network"? If you are shy, can you skip the networking part of the meeting?

The Value of Networking

Our social relationships are at least as important for our health as eating nutritious food and exercising. We tend to make social connections based on common interests, values, and time devoted to a particular activity. If you are spending 35+ hours a week working in agronomy, chances are that you have already connected with other professions in the agronomic sciences and related fields. Your professional network serves several purposes.

It provides you with a community who understands the challenges of your work and applauds your successes. The more specialized you become in your agronomic field, the more difficult it is to find colleagues who truly appreciate the nuances, uncertainties, and difficulties of your day-to-day research tasks. It can be validating to know that you are not alone! Talking with other researchers may uncover a solution to problems that have left you feeling confounded for days, weeks, or longer. On the flip side, your helpful suggestion to a scientific colleague may come at a key moment for them. We are all in the agronomic sciences together!

Job opportunities are often shared through professional networks. Being part of a network allows you to take advantage of personal and business connections rather than relying solely on your resume or curriculum vitae (CV) to convey your abilities. Employers must necessarily check the education,

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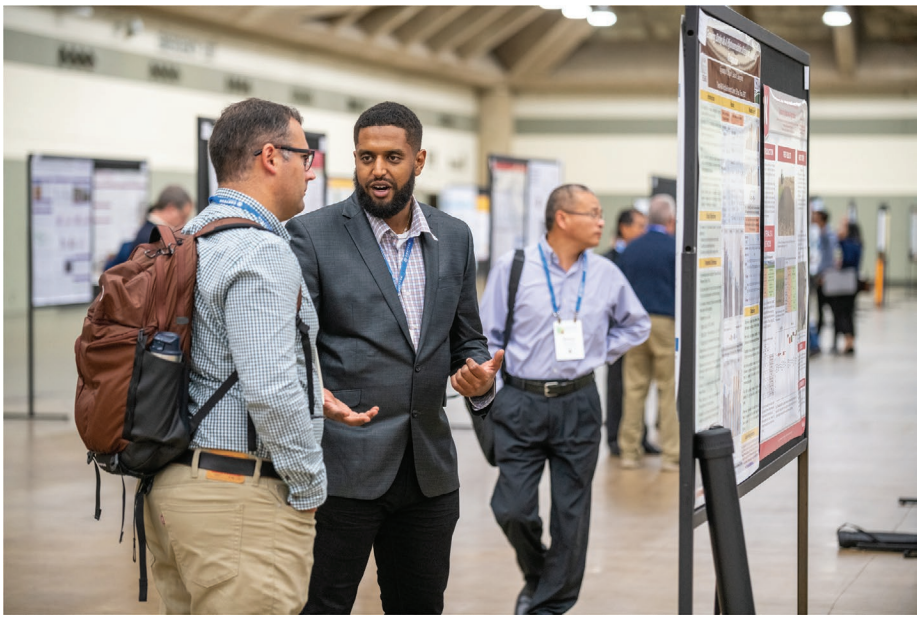

Your professional network serves several purposes, such community support, job opportunities and career advancement, and mentoring. Photo by Remsberg.

qualifications, and interpersonal skills of the individuals they hire. As a job seeker, you will need trusted professionals in your network who are willing to vouch for your suitability for a particular job by providing a verbal or written reference.

As a member of a professional network, you will also gain access to the unadvertised jobs market. You may not know this, but many employers prefer to recruit through "word of mouth" rather than by a formal recruitment process. In the United States, it is estimated that 1.5 million available jobs are not advertised. Since only 45 jobs out of every 100 jobs are advertised, this means > 50% of the available positions are hired informally. Those who find jobs in the hidden job market are individuals who effectively network with other people. The ASA Annual Meeting is a great place to make contacts and impress a potential employer with your skills, energy, and motivation to work in agronomy!

Career development and advancement often require you to step outside your comfort zone and engage in activities that extend beyond the responsibilities of your present position. Employers are on the lookout for employees who show signs of being ready to take on a new role in their organization, but you could also gauge your readiness for a new challenge by applying for a position at another institution. As you prepare for your next career step, it is a great idea to consult with others in your professional network who know your field well. They can advise you on what activities and skills will be the most effective for you to demonstrate career development, helping you move to the next position or get that well-deserved promotion.

Mentoring Matters

Speaking of advice, you are likely to find many mentors in your professional network. Since a professional network is dynamic and cooperative, one of the functions of your professional network is to provide a safe space where you can ask for help and give help in return. This often occurs informally, in casual conversation or while having a meal together, when people tend to share and discuss various issues they are having at work or in their research. Mentoring can also occur formally, when mentors are matched with mentees. In formal mentoring, there is an expectation that the mentor and mentee will meet regularly to discuss various topics—research progress, professional growth, managing interpersonal relationships, establishing a work–life balance, and so on.

All ASA members can reap the rewards of informal mentoring. As an ASA member, you are most welcome to participate actively in the sections and communities that best align with your interest. Please feel free to post to the discussion boards (agronomy.org/discussion-boards/) when you have ideas or information to contribute to your section or community. When you need scientific advice, you can find world-class experts in our member and scientific expertise directories (agronomy.org/membership/directories). Finally, the next ASA Annual Meeting, as well as your local branch or chapter meeting, is a wonderful opportunity for you to meet colleagues with shared interests that could yield many possibilities—job offers, research partnerships, co-authorship on science papers, invitations, etc.

ASA also offers formal mentoring programs targeted at young professionals. The Golden Opportunity Scholars program (goldenopportunityscholars.org/) supports undergraduate students seeking to attend further education in the agronomic sciences. The successful students are paired with a mentor who is a Society professional with similar interests and career goals. Greenfield Scholars are also undergraduate students,

ASA also offers formal mentoring programs targeted at young professionals. The Golden Opportunity Scholars program (goldenopportunityscholars.org/) supports undergraduate students seeking to attend further education in the agronomic sciences.

and these students express an interest to enter the industry upon graduation and pursue the Certified Crop Adviser (CCA) or Certified Professional Agronomist (CPAg) profession and certification. Their mentor is a CCA in their region, who can help them understand the industry and identify potential clients in the area.

If you know of meritorious undergraduates who would benefit from these programs, or you are interested to be a mentor, please contact Brigid Moran, Manager of Student and Early Career Programs, at bmoran@sciencesocieties.org or 608-268-4949.

ASA is also proud to be part of the ASA, CSSA, and SSSA Peer Review Mentoring Program (agronomy.org/publications/journals/peer-review-mentorship), developed for early career professionals (graduate students or postdoctoral fellows) to receive hands-on peer review training over the course of six months. Accepted applicants will be paired with an experienced mentor in their field and will be guided through the process of reviewing for an ASA, CSSA, or SSSA journal. To learn more about this publications opportunity, please contact Matt Wascavage, Director of Publications, at mwascavage@sciencesocieties.org or 608-819-3916.

Can You Skip Networking If You Are on Social Media or Are Shy?

Earlier in this article, I asked the question, "If you already have a social media presence, do you need to work on your 'network'?" I asked Google and the answer I received in <1 second was a resounding YES! (according to five sources). Research finds that face-to-face interactions are more positive than online interactions because trust between individuals is very strongly rooted in nonverbal cues, including facial expressions, tone of voice, and firmness of the handshake. In-person interactions are more focused and less prone to distractions. This helps you to find common ground and align with the other person more quickly and effectively with less chance of being misinterpreted. Being with another person in the flesh creates a stronger foundation for a long-lasting professional relationship than meeting through social media.

I am sure you can already guess my answer to the other question I asked earlier: "If you are shy, can you skip the networking part of the meeting?" Answer—NO! To begin with, no one at the ASA meeting knows that you are shy. So you can be "not shy" when you come to the ASA meeting. Being "not shy" means that you greet someone you don't know (smile and wave, say hello). With advance preparation, you can think of different ways to start a conversation, ask a question, or complement someone on their interesting agronomic research. If you are intimidated by the idea of asking a question in an oral presentation session, you could plan to have a conversation with a smaller group in the exhibit hall or an individual presenter in the poster sessions. Practice introducing yourself, and plan to address your new scientific friends by name to build a strong personal connection. I hope these ideas will help you feel comfortable in growing your professional network at the next ASA meeting.

Please do not hesitate to contact me and the other members of your ASA Board of Directors, as well as your section and community leaders, with your ideas, stories, comments, questions, and concerns. We look forward to hearing from you!

STUDENTS

Building Mentorship Relationships in Graduate School

By Rachelle Davenport, Ph.D. Candidate at Cornell University and Chair of the ASA, CSSA, and SSSA Graduate Student Committee; and Elizabeth Bradley, Ph.D. Candidate at Auburn University and SSSA Graduate Student Board Representative

Mentorship, the guidance provided by a more experienced or knowledgeable person, is an essential part of career development inside and outside of academia. Even so, a 2019 *Nature* survey showed that career guidance and advice was the biggest area of concern for graduate students with 60% stating they arrived at their current career decision by their "own internet or other research" (Woolston, 2019; find the full survey results here: http://bit.ly/3NnXj8X). A further 29% of graduate students reported seeking advice from fellow colleagues. When it comes to career development, graduate students have the opportunity to build their own mentoring relationships outside of the one they have with their advisers. Because the reality is even though many advisers are amazing scientists and mentors, they are only one person and often have other responsibilities and obligations. Therefore, building a small "team" of mentors that can assist you in developing networks, technical skills, and knowledge while improving confidence, enthusiasm, and career satisfaction will be the most effective mentorship strategy to have in graduate school. Below we provide an approach to building mentoring relationships.

Finding and Building Mentorship Relationships

The first step to finding and building mentorship relationships is to identify your own needs first. What you need from mentorship will depend on your current skills, where you are in your career, and where you want your career to take you. Develop a short list of priorities you would like to focus on during your

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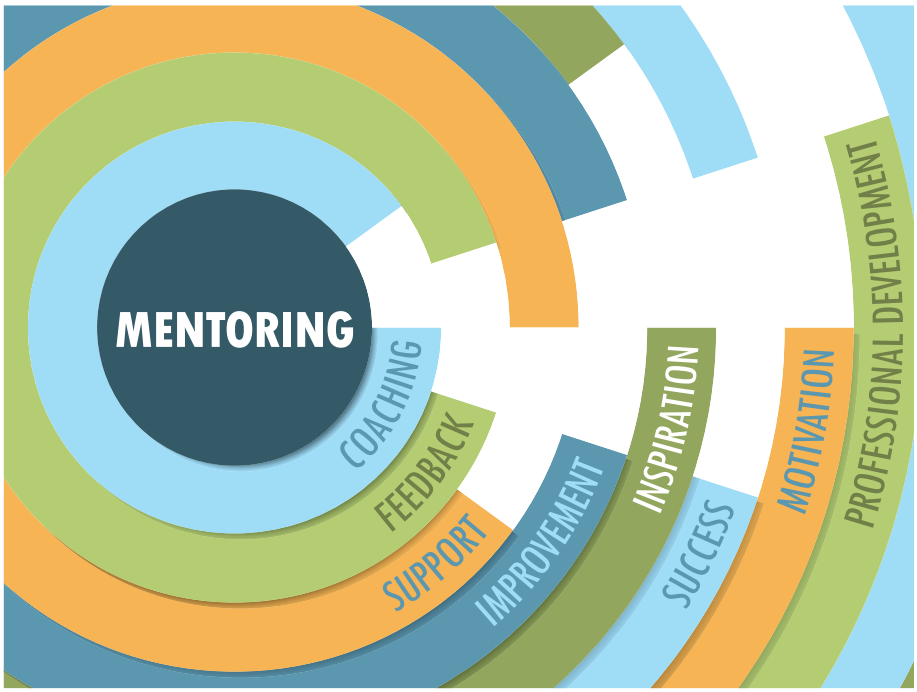

Mentors can provide numerous benefits, but what do you need most? Develop a short list of priorities you would like to focus on during your graduate program. Depending on your current experience and skill set, these goals may include improving technical skills, networking, or preparing for your career. Photo courtesy of Adobe Stock/treenabeena.

Informal mentors could include a previous or more senior graduate from your lab. Photo by Jay Oliver and courtesy of Flickr/UGA CAES/Extension via a CC BY-NC 2.0 license (https://creativecommons.org/licenses/by-nc/2.0/).

graduate program. Depending on your current experience and skill set, these goals may include improving technical skills, networking, or preparing for your career, whether that be in industry, academia, government, etc. For those seeking a future in academia, this could include grant-writing experience, seeking out collaborations and co-authorships, getting involved in committees on campus, or seeking experience with lecturing. For those seeking a future outside of academia, this could include seeking internships, building your network in industry, or focusing on improving technical skills. If you do not know exactly what career path you want to take yet, you can prioritize finding a few mentors that can share their experiences and help you identify which paths would be the best for your career goals.

The second step to finding and building mentorship relationships is to identify your current mentorship opportunities. During graduate school and later in your career, there are formal mentorship structures in your workplace to engage with as well as opportunities to develop informal mentorships. It is your responsibility to find and use these opportunities. You may find that people in your formal mentorship structure in graduate school may be well suited to helping you work towards many of the goals you have identified.

The formal mentorship structure provided by your program usually includes your principal investigator (PI)/adviser, committee, and the graduate education personnel on campus. Your adviser is the head of your formal mentorship structure. They provide the traditional one-on-one involvement that most people think of when they think of mentors. They work with you to help schedule your degree path, develop the objectives and directions of your research, suggest opportunities, and guide you toward the completion of your research and degree.

Graduate students also have a committee of experts that provide feedback on project development, technical skills, and methodologies. They often provide feedback on writing, recommend opportunities, and generally guide graduate students to the completion of their degree. Some programs have largely pre-established committees while others encourage greater involvement in the selection of committee members by the graduate student. Regardless of your program, it is wise to evaluate your committee members and determine whether they have experiences or perspectives that align with what you are seeking from mentors.

In addition to your adviser and committee, there is often personnel associated with your graduate program who can help guide you through your program and teach you valuable skills for your career. This can include everyone from the graduate program administrator who can advise you on timelines for graduation and the submission of graduate documents to the accounting personnel who can guide you on managing project funding and university purchasing requirements.

It is important to not overlook the opportunities for mentorship in the formal mentorship structure; however, it is unwise to focus exclusively on formal mentorship structures. This is especially true according to the 2019 *Nature* survey, which found that nearly half of

The final step of finding and building mentorships is to approach the potential mentor and begin to build a relationship with them.

graduate students report "spending less than an hour one-on-one with their supervisor each week" (Woolston, 2019). Likewise, as valuable as their expertise may be, committee members are often busy with their work and are limited in the time they can provide; therefore, we recommend having informal mentors in addition to your formal mentors.

Seeking potential mentors outside your formal mentor structure will increase the perspectives and experiences you are exposed to while reducing the demands on each mentor. Informal mentors could include a previous or more senior graduate from your lab, a post-doc that works on a topic you're interested in or someone who received their degree from a lab or university you are interested in, or a researcher across campus who obtained a fellowship to collaborate with another university abroad. It could simply be a scientist you met at a conference whose career path you admire. Informal mentors are individuals you seek to learn from outside formal mentorship structures in your career.

The process of identifying potential mentors may seem like a daunting task, but the process is simple once you've identified what you would like to accomplish as a mentee. Ask yourself the following questions: Is this a person you admire? If so, does this person have an experience, skill set, or perspective that aligns with your career goals? Just because you admire a person doesn't mean they have something useful to your goals to learn from. Does this person enjoy their work? Advice from someone successful but ultimately unsatisfied with their work life is unlikely to lead you to the career you seek. Does this person seem like someone I could get along with? Mentorships rely on effective communication and aren't supposed to feel like a burden or a chore. Finally, ask yourself: Is this someone capable of guiding me? They may have the career of your dreams and get along well with you, but they may not be able to provide the kind of objective guidance that fosters true mentorships. Answering the final question may not be possible prior to getting to know the potential mentor, but it is essential to successful mentorships.

The Societies' Annual Meeting can be a great place to connect with potential mentors.

The final step of finding and building mentorships is to approach the potential mentor and begin to build a relationship with them. Often, graduate students are reluctant to reach out and seek mentorship because it feels like they have nothing to offer the mentor. This is not true. Mentors often describe mentees as contributing to career satisfaction, exposing them to new ideas and methodologies, expanding their networks, and growing their research lab. Word of good mentors gets around and can attract great new students to the mentor. So, accepting that you contribute as a mentee and that everyone was once in your shoes can reduce anxiety over approaching a potential mentor. Since you have already identified what you could learn from this person, it should be relatively easy to approach them. Reaching out to a potential mentor is as simple as letting them know what you are interested in learning from them and asking if they'd be willing to discuss it with you. We've included an example below.

> *"Dear [Name], I'm a graduate student studying [topic]. I saw you [reason you are interested in this potential mentor, such as a recent seminar talk]. I am really interested in learning more about [what you hope to gain from them]. Would you be willing to discuss it over coffee sometime? I look forward to hearing back from you."*

As you can see, you do not have to formally ask anyone to be your mentor but merely ask for some of their time to hear about their experiences and advice you may be seeking. Often, an informal conversation over coffee can develop into a more structured mentorship relationship.

Maintaining Mentor Relationships

While there are clear benefits to both mentors and mentees, maintaining effective mentorships requires both parties to invest time and effort. This requires mindfulness of mentorship etiquette and mutual respect between mentors and mentees. Below are some mentorship etiquette recommendations.

Mentee Etiquette

Out of respect for the experience and limited time of the mentor, it is essential for mentees to be mindful of their role as a mentee. It is generally the responsibility of the mentee to take on much of the initiative in the mentorship. Not only should mentees be the ones to reach out to the mentor to schedule a time to talk or to meet up with each other, but it is also the mentee's responsibility to lead the discussion with concise communication and clarity of expectations. This means that it is the mentee's responsibility prior to meeting with their mentor to identify what they need, consider possible solutions and routes of addressing the issue at hand, organize their thoughts and concerns, consider how the mentor might be able to help them, and go into the meeting with a teachable mindset. While meeting with their mentors, mentees should actively listen to what they have to say, be open to perspective and potential guidance, and be grateful for their mentor's time. After a meeting, mentees should follow up with their mentor.

It is important to understand that mentors are not miracle workers. They can simply provide their perspective and insight. It is your responsibility to communicate what you need from your mentors and be understanding if they are unable to provide it. Additionally, we strongly encourage mentees to communicate with their mentors regardless of their schedule and

Take advantage of the career development activities and workshops offered by your graduate school, such as writing workshops, information sessions about careers outside of academia, interview preparations, how to negotiate job offers, and informal social-networking opportunities. Photo courtesy of Adobe Stock/kasto.

workload. Using a tiered mentorship structure, with many mentors to reach out to at different stages of career, will be the most beneficial for you during graduate school. However, your formal mentorships should take precedence over your informal mentorships using this kind of mentorship structure.

Mentor Etiquette

Mentorships are not the responsibility of the mentee alone. Mentors should also listen to the needs and concerns of their mentees, get to know them and their goals, and consider how their experience and skill sets might be useful or applicable to their mentee's situation. When mentees reach out with a concern or a request to meet, responding in a timely manner will demonstrate the respect you have for their time and that you value being a mentor to them. In addition to spending time with your mentee, you could also keep an eye out for opportunities to nominate them for awards or scholarships or send them information on helpful workshops or even grant opportunities. When mentees seek guidance for a situation, mentors should take a moment to consider whether this is an opportunity to offer to assist the mentee, provide advice on how to handle the situation, or provide a different perspective and allow the mentee to come to their own conclusions about their situation.

Sometimes what mentees need more than solutions to their problems is the opportunity and guidance to create their own. We encourage mentors to respect the decisions and obligations of their mentees. Good mentors are able to provide perspective and experience without trying to advise a mentee on a direct choice of action. They allow the mentee to come to their own conclusions and respect that the mentee is ultimately responsible for their own decisions. You may not have handled a situation or made the same decision as your mentee, but that does not necessarily mean that the mentee is wrong or doesn't value your guidance. Accepting that your mentee will make the best decisions that they can demonstrates clear respect for them as individuals.

Building Mutual Respect: Respect for Mentors and Mentees

Mutual respect is the foundation of effective mentorships. As we discussed in our suggestions to mentees and mentors, respect for each other's time, experience, and perspective is essential. Communication and active listening between mentors and mentees are key ways to express mutual respect. Another is to be mindful of the obligations and responsibilities of each other. As much as mentees need to remain mindful of the obligations

The most prominent opportunity for career development hosted by ASA, CSSA, and SSSA is the annual Graduate Student Leadership Conference, which is aimed at teaching graduate students how to be ethical leaders, effectively work in groups, and foster inclusion at their workplaces.

and commitments of their mentors, mentors need to be just as mindful of the obligations and commitments of their mentees.

Tips for Mentorship Success

There are a number of different ways to develop your career outside of formal and informal one-on-one mentorship relationships. Typically, the graduate school at your institution will host a range of career development activities and workshops throughout the year, such as writing workshops, information sessions about careers outside of academia, interview preparations, how to negotiate job offers, and informal social-networking opportunities. These opportunities are designed to assist you throughout your graduate studies and help you achieve your career-related goals—take advantage of them.

Outside of your academic institution, there are also a wide variety of events and workshops to aid your development. The Societies provide numerous avenues for graduate students to obtain mentorship. The most prominent opportunity for career development hosted by ASA, CSSA, and SSSA is the annual Graduate Student Leadership Conference, which is aimed at teaching graduate students how to be ethical leaders, effectively work in groups, and foster inclusion at their workplaces. In addition, the annual Graduate Student Networking Session at the Annual Meeting brings together mentors from various career sectors with graduate student mentees. This session gives graduate students the opportunity to ask those further along in their careers for insight into what it's like to work in academia, non-profit organizations, industry, or government positions. A complimentary session hosted with the Early Career Members Committee this year connected graduate students and early career members with panelists from various fields to improve transparency in the application and job negotiation process. Finally, the Graduate School Workshop at the Annual Meeting is an opportunity for graduate students to provide insight to undergraduate students interested in attending graduate school.

As you can see, there are numerous ways to obtain career guidance outside the formal mentorship structure. If you have established mentors and a clear career path, this could be a good time for you to volunteer to be a mentor yourself to more junior graduate or undergraduate students. It is also wise to expand your mentoring scope outside your institution or field, such as collaborators at different institutions or even outside of academia altogether. Mentors can also be members of your community that you have formed a bond with that can help you navigate the more personal aspects of your life, such as making tough decisions and how to ensure you have healthy work–life balances. Don't undervalue the relationships you build with mentors and mentees during your time in graduate school as they will likely support you for decades to come.

Helpful Resources

Haynes, L., Adams, S., & Boss, J. (2008). Mentoring and networking: How to make it work. *Nature Immunology*, *9*, 3–5. https://doi.org/10.1038/ni0108-3

Lee, A., Dennis, C., & Campbell, P. (2007). Nature's guide for mentors. *Nature*, *447*, 791–797. https://doi.org/10.1038/447791a

Woolston, C. (2019). A message for mentors from dissatisfied graduate students. *Nature*, *575*, 552–551. https://doi.org/10.1038/d41586-019-03535-y

EARLY CAREER MEMBERS

Mentoring Graduate Students to Help Them Grow Academically and Personally

By Robert Horton, Distinguished Professor of Soil Science at Iowa State University

I am honored by the invitation to provide some advice to early career members. Many years have passed since my early career. I am now completing 40 years as a soil science faculty member, and during this time, I served as major professor for several M.S. and Ph.D. students and postdocs who now have established careers in soil science. More than 20 of my former students (that is, my academic "children") are currently faculty members who mentor their own students, and through them I now have more than 200 "grand-students."

Careful mentoring is essential because it has generational impacts. Therefore, it behooves us to think of mentoring graduate students more like familial relationships than like business deals. Just after I was hired at Iowa State University, I met Professor Emeritus Don Kirkham. I felt a bit intimated because Dr. Kirkham held enormous stature in the soil physics community while I was a new graduate just beginning my career. Dr. Kirkham asked me who I had studied under, and I told him the names of my professors. He responded by saying that my M.S. professor was his former Ph.D. student, and my Ph.D. professor was a student of his former student, so he immediately identified me as his grand-student and great-grand-student. As we shook hands, my sense of intimidation vanished, and I immediately felt welcomed into his academic family.

Approaching mentoring as a rite of passage or entry port of students into one's academic family is far more rewarding and beneficial than viewing students as "worker bees" with a primary focus on short-term goals. Developing the mentoring relationship and serving students in a manner that helps them grow as people and scientists can bear healthy fruit—potentially for generations.

My favorite part of my faculty job is mentoring graduate students and postdocs. My goal is to help each student grow as a person and as a scientist in preparation to successfully move to their next stage of life. I count it a blessing to have had the opportunity to mentor many outstanding people. I begin my mentoring advice by providing some background information on how I was mentored as a graduate student.

The column is brought to you by the Early Career Members Committee (ECMC), which serves members beginning their careers—new professionals and graduate students in agronomy, crop, soil, and environmental sciences. The ECMC consists of members from each of the three Societies who serve three-year terms. Learn more at www.soils.org/membership/early-career. This month, the Early Career Members Committee has invited Dr. Robert Horton to provide some perspectives for early career members on mentoring graduate students.

Authoritarian and Authority Mentorship

I studied for an M.S. degree in soil science at Texas A&M University under the direction of Dr. Cornelius van Bavel. Dr. van Bavel was a well-established, highly recognized expert in soil–plant–water relationships. I was a new graduate student with very little research experience. Dr. van Bavel provided me with a research assistantship to work on a project evaluating how well various mulch materials could help conserve fallow period soil water for the following crop. Dr. van Bavel was a no-nonsense adviser, and he expressed himself quite strongly in our relationship. We had weekly meetings at which I reported on my research progress, and he gave me directions on the next week's work. He carefully guided my research progress. If I progressed on the research, he complimented me, but sometimes there was yelling when I failed to fulfill the

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Mentors can take either "Authority" or "Authoratarian" style mentorship approaches to foster their students as scientists and people. Photo courtesy of Adobe Stock.

scheduled work. I refer to this type of mentoring as an **Authoritarian style**. The professor is the "boss" and the student is the "worker."

I studied for a Ph.D. degree in soil physics at New Mexico State University under the direction of Dr. Peter Wierenga. Dr. Wierenga had a somewhat hands-off approach in working with me. He told me that his office door was always open and that I could speak with him as needed. He also made it clear that he was not going to babysit me. As a Ph.D. student, it was my responsibility to select a research topic. He was not going to tell me what to do. He worked hard, and he expected me to work hard.

I refer to this type of mentoring as an **Authority style**. The professor is available to provide advice and guidance to the student while the student has quite a bit of freedom to explore, think, engage with, and take ownership of their research project.

On a personal level, I felt some interior shock (like, "Wow!") when I began my Ph.D. program because Dr. Wierenga's approach to mentoring was just about 180 degrees different from the approach used by Dr. van Bavel. In hindsight, I see that both styles were perfect for me in how each matched my own stages of development.

I experienced both styles of mentoring: Authoritarian and Authority. With the Authoritarian style, the mentor acts as a direct, hands-on leader. They know what needs to be done, and they direct the action of the student. This is more about telling a student what to do instead of asking the student what they think. This style is most appropriate when used for students who have little research experience. Because the student needs close guidance, this mentoring approach actually serves the student well during their early developmental stage. The downside of this approach comes when it is applied for too long. It tends to be controlling in nature and may not allow a maturing student the proper opportunities to grow and develop. More experienced Ph.D. students may feel oppressed by this mentoring style. The work environment takes on an uncomfortable, stranglehold feel—like a necktie that is too tight.

In contrast, the Authority style of mentoring gives a wide swath of freedom to the student. More experienced students usually welcome this approach because it provides them increased opportunities to grow and develop as seasoned scientists. An Authority-style mentor does not ignore their students; rather, they purposely step back to give the students an opportunity to take ownership of their research project. The mentor serves the student by acting as a resource of experience and insight and collaborates *with* the student on a project. Empowering students can build their self-confidence. This is a relational mentoring style that focuses on teamwork. It is important to understand that the Authority style encourages a student to think, make suggestions, and propose ideas and directions, but the student is not totally independent. To succeed, this mentoring style requires a healthy interdependence, which includes the kinds of talks, evaluations, and decision points that build deep trust in the mentor–mentee relationship.

When matched well to the developmental stage of a student, both Authoritarian and Authority mentoring styles can effectively serve students.

"Reverse Funnel" mentorship sees a student move from the confines of the narrow neck of the funnel into the relative freedom of the funnel's broad opening. Photo courtesy of Flickr/Mike Finn.

The Reverse Funnel Approach

We are all familiar with how a funnel works. The neck of the funnel directs liquid from its mouth into another container. The "reverse funnel" mentoring approach starts with a horizontally positioned funnel.

Imagine a beginning student entering the funnel neck, and as the student gains research experience, they advance from left to right through the neck and out of the mouth. The funnel walls represent boundaries placed on the student while the space between the walls represents the range of freedom given to the student. Note that as the student advances out of the neck, the walls are further apart, so there is greater freedom.

A new student with little research experience begins in the funnel neck. This indicates that the mentor creates tight boundaries for the student. The mentor must carefully guide and coach the student in the early stage, helping the student form good research habits and experience. Perhaps this represents a new M.S. student. With time, the student emerges from the neck as they grow in knowledge, skills, and experience. The tight research boundaries on the student's research activities begin to loosen. In discussions, the mentor starts to encourage the student to be the first to express ideas and concerns about the project, rather than telling the student what to do and how to do it. As the student continues to advance, the boundaries continue to expand and the mentor affords the student more freedom to lead the discussion, planning, and implementation of research. This stage might include senior M.S. students and Ph.D. students. Finally, by graduation, the student is fully prepared to exit the funnel and move forward to the next stage of their career, including the possibility of mentoring their own students.

How I Mentor Graduate Students

Early in my career as a mentor, I acted as the boss of my group, like an authoritarian. I gave the orders, and I expected my students to obey them. As I gained experience in advising students, I chose to better serve my students by listening to them and empowering them, acting more like an authority and a resource. I am particularly drawn to the Authority mentoring style because at its heart, it flips the script that says the mentor should make all the research decisions due to their greater experience. Instead, the Authority-style mentor purposely chooses to serve the student by requiring the student to express themself first before providing input.

The greatest joy of my career is working with graduate students and young scientists. I have learned that effective mentoring is a labor of love, and the fruit of purposeful mentoring is its positive impact on the next generation of scientists, which in turn impacts the following generation, all the way down the academic family tree.

Most scientists in the early stages of their careers will suddenly find themselves in the dual role of being a mentor while yet being a mentee. Source: Adobe Stock/SurfupVector.

EARLY CAREER MEMBERS

Mentor or Mentee? An Early Career Perspective

By Aaron Lee M. Daigh, Ph.D., Associate Professor of Soil Physics and Hydrology, North Dakota State University

An "early career member" is anyone who recently graduated from college and is generally within the first decade of their career. This is a time of major change when most will suddenly find themselves in the dual role of being a mentor, while yet being a mentee, in the early stages of their careers. The partitioning of being mentor vs. mentee tends to split more equally during this period of life. Your scale of contributions to these roles may also peak during this time. Below, I briefly note some types, structures, benefits, and pitfalls of mentor–mentee relations. Moreover, I provide some viewpoints I have gained in the seven years since my last degree. I hope this article will provide encouragement and vigilance as you experience this dual mentor–mentee role, regardless of where you are at in your career.

Mentor, Counselor, Sponsor, Coach, and Guide—Is There a Difference?

The dictionary defines mentor as "a trusted counselor or guide." The term actually comes from the character "Mentor" in the ancient Greek literature *The Odyssey*, by Homer. In this sequel to the *Iliad*, Odysseus is lost at sea after a brutal war. During his absence, a trusted friend, Mentor, helps to guide Odysseus's son from birth to adulthood.

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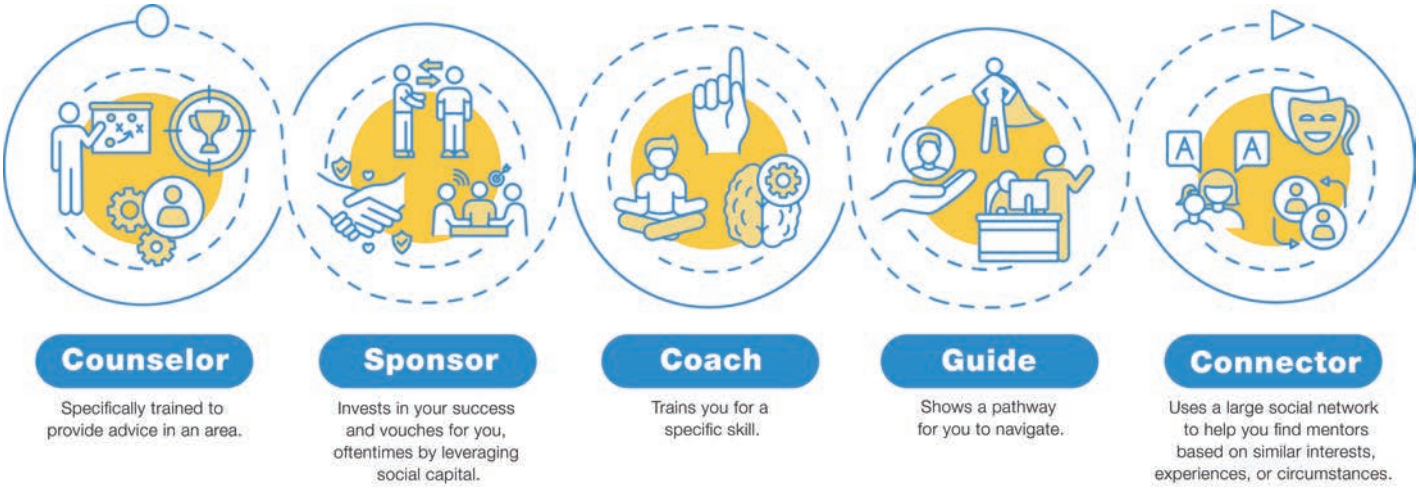
In general, mentor is a broad category containing many types of relationships. Counselor, sponsor, coach, guide, connector, etc. are examples of mentors. Each has specific perimeters constraining the relationship:

- **Counselor:** Specifically trained to provide advice in an area.
- **Sponsor:** Invests in your success and vouches for you, oftentimes by leveraging social capital.
- **Coach:** Trains you for a specific skill.
- **Guide:** Shows a pathway for you to navigate.
- **Connector:** Uses a large social network to help you find mentors based on similar interests, experiences, or circumstances.

Structures, Pros and Cons of Mentorship

Mentorship has always been vital for aiding success. It is most essential when great uncertainties strike (e.g., the current pandemic, economic, and humanitarian crises) and our vision narrows to the immediate. Even the immediate may blur. The following are some popular structures, always used in some combination, to formulate the setting between mentors and mentees:

- **Formal Mentoring:** Individuals assigned to each other in accordance to an organization's policies. It ensures members receive formal guidance and feedback but carries the risk of mere compliance (box checking), low motivation, and even resentment from involuntary mentors.
- **Informal Mentoring:** A volunteered relationship based on similar interests and compatibility. There is little to no power dynamics since the mentor has no supervisory or evaluative responsibilities over the mentee. There is a risk of trading objectiveness for favoritism when a friendship develops.
- **Dyadic Mentoring:** Relationship between one mentee and one mentor where the logistics and scope of interactions are typically their choice. While there is a high potential for honest and attentive discussions, there is also a risk of merely duplicating the mentor.
- **Triad, Group, and Network Mentoring:** Settings where multiple mentors/mentees discuss topics together while the mentee(s) learn and integrate the information on their own. This aids in aligning the intersections of multiple disparate skills and life situations, but there is a risk of peer pressure if mentors are homogenous and imply a sense of authority.
- **Developmental and Career Mentoring:** Long-term relationships during mentees' developmental milestones or various stages of their careers. There is consistent advice that is well-informed of the mentees' context but also the risk of becoming reliant on the mentor for direction, which stifles creativity and novel career paths.
- **Reverse Mentoring:** Older executives and personnel mentored by younger members on current trends, emerging topics, technology, and social media. Senior personnel stay applicable while the younger mentor becomes connected and invested to the organization. However, there is a risk of anxiety due to power dynamics and generational ideologies.
- **Micro-Mentoring:** Brief advice to specific questions through social media. It has the benefit of rapid and concise input



Counselor, sponsor, coach, guide, connector, etc. are examples of mentors. Each has specific perimeters constraining the relationship. Source: Adobe Stock/bsd555.

from vast networks but also the potential for inconsistent or dishonest advice/feedback with ulterior motives.

- **Peer-Based Mentoring:** Similarly skilled members sharing current experiences and giving feedback. There is a direct ability to relate to issues, perceptions, and navigational barriers as well as the potential for confirmation bias, favoritism, and hidden competition.
- **Situational Mentoring:** A short-term relationship that focuses on coaching. There's the benefit of a clear objective with a well-defined outcome. On the other hand, the mentoring is limited in scope and ability to address intersecting needs.
- **Virtual Mentoring:** Relationship held and maintained from differing locations. It's logistically flexible and facilitates mentoring outside of the mentee's organization but also carries the risk of sparse or untimely feedback.

The early career perspective on mentoring is a precarious position. Are you a mentor or a mentee? Do you know how to mentor and whether you are ready? Was I a good mentee? What does "a good mentee" even mean? You may feel moments of comfort along with a sense of self-confidence while at other times you feel uncertain and disoriented with the desire to call out for advice. The following tips may be useful when addressing these questions.

"Some mentees will surpass you and go on to higher levels of skill or success. Be proud and humbled. Do not compete with them. Hope all your mentees will reach such an accomplishment. This is the greatest complement mentors can receive."

Tips for Being a Mentor

- **Listen, Facilitate.** Provide honest listening of your mentee's situation and context, know when to validate their feelings by sharing relevant experiences during their journey, and give advice that they are in no way obliged or pressured to follow. Also, gain insights from you mentee's experiences to improve yourself and relevancy of your advice. Mentors are innately part mentee in the relationship if you listen and follow up attentively.
- **Avoid Microaggressions, Practice Microinterventions.** We all have explicit and implicit biases. Moreover, we all have actions that negatively affect others without being aware. A mentor is a model of professionalism and humanity. Practice identifying common microaggressions. Practice microinterventions on yourself and others. Read Sue et al. (2019) and Sue (2010) to learn about microaggressions and interventions.
- **Avoid Mentor Malpractice.** There are active (hijacker, exploiter, possessor) and passive (bottleneck, country clubber, world traveler) types of mentor malpractices. Read Chopra et al. (2016) on how to diagnose and treat these malpractices.
- **Be Aware of Potential Mentee Missteps.** See "Tips for Being a Mentee" section below.
- **Take Pride in Your Mentee's Success.** Some mentees will surpass you and go on to higher levels of skill or success. Be proud and humbled. Do not compete with them. Hope all your mentees will reach such an accomplishment. This is the greatest complement mentors can receive. In fact, great mentors help people who have already outgrown them continue to outgrow them even more. Mentoring is not about making mentees into you but about helping them be the best version of what they want.

Tips for Being a Mentee

- **Integrate across Disparate Mentors and Yourself.** Have many different types of mentors. Retain some mentors and change other frequently. Read Liénard et al. (2018) on how combining elements from multiple mentors of disparate skills/perspectives with your own strengths can lead to greater outcomes.
- **Avoid Mentee Missteps.** A changing world induces stress, and your reactions will affect the functionality of your

mentorship. There are conflict averse (overcommitter, ghost, doormat) and confidence lacking (vampire, lone wolf, backstabber) types of mentee missteps. Read Vaughn et al. (2017) on how to diagnose and treat these missteps.

- **Be Aware of Potential Mentor Misconduct.** See "Tips for Being a Mentor" section above.
- **Take Responsibility, Own Your Successes.** All mentors are human, flawed, and have a different background that has molded their perception of the world. Your goal is not to become your mentor or role model—it is to become the best version of you. Your mentor helps you to discover your latent abilities and provides insights on various pathways you might journey.
- **Actively Participate in the Process.** Interpret, analyze, and contextualize your mentor's advice. Is it relevant to your personal circumstances, career stage, and goals? Is it still relevant in today's career environment? Then integrate the advice into the idiosyncrasies of your next steps. In doing so, you do not just become your mentor or what your mentor views you as, but you become a better version of yourself that you actively participated in and only you own.

Navigating Your Walls

Mentors help guide mentees beyond their invisible walls. Here, the wall is metaphorical and represents the unknown quantity of tasks or effort mentees can take on before progress stops. Pressing and banging against the wall is unproductive. However, knowing where it is located is of immense value. Most of us do not know precisely where our wall is because it shifts over time throughout our lives—intellectually, socially, physically, and interest wise. Knowing your indicators that the wall is "nearby" will serve you well. Great mentors help mentees see the indicator when the mentees do not sense it themselves.

Source: Adobe Stock/Lightfield Studios.

Stepping out of our comfort zone is not the same as stepping up to the wall. It is more like finding a new path through the maze of walls. The existence of your wall does not imply it is the only direction to move forward in. Navigating outside of your comfort zone can trigger incredible creativity you never knew you had. New thoughts, opinions, and perspectives rush to the forefront of your mind during and after these uncomfortable situations. However, these only occur when you are not up against your wall and you have room to move.

Mentors can help give their perspective on where you are relative to your own personal wall if you have built a dual relationship with honesty, trust, and open communication. Nevertheless, mentors can never have an absolute picture of what mentees are enduring, thinking, and feeling to precisely assess where the mentees stand relative to their walls. Therefore, mentees have to not only listen to the advice, thoughts, and perspectives of their mentors, but they also have to place those inputs into the context of their own lives and perspectives to make the most use of them. Good mentees do not just listen and do. They listen, think, remold the advice, and then apply it in the way that best serves themselves and their goals.

We are all mentees throughout our lives in some area. You will always be a mentor to someone else too, whether you know it or not. This dual role of being both a mentor and mentee is a good thing and needed for society to progress forward beyond its walls.

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ASA President's Message

Mentoring Matters

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Most people who have been successful as a student or in their career will indicate that effective mentoring played a role in their accomplishments. I present this topic as a means of encouragement to seek out a mentor or provide mentoring for the benefit of yourself and your organization and to provide the basic characteristics of effective mentoring to stimulate your interest in learning more. Mentoring takes many forms, ranging from short-duration efforts such as our Golden Opportunity or Greenfield Scholars programs to career-length efforts that span decades. Each of us has or will likely have multiple mentors over our careers. To reinforce this topic, I encourage you to reflect back on your life and list the people that have been a positive influence. Most likely, many of those people were your mentors, whether you realized it or not at the time.

Forming an Effective Partnership

Often mentor/mentee relationships develop informally and are simply the result of some combination of a mentee seeking assistance and the mentor trying to be helpful. Effective mentoring is a partnership between the mentor and the mentee, sometimes as formal as a written contract defining the duration of the mentoring or the frequency of meetings and sometimes just an understanding that mentoring is taking place. Mentoring can facilitate the success of anyone, regardless of their status in their academic or professional careers. Each member of the partnership can act in ways that enhance the effectiveness of the mentoring, particularly when the partnership exists over extended periods of time.

Regular communication, regardless of whether any problems exist, is essential. The mentee must be the more proactive partner with regard to initiating communication in order to avoid the perception that no communication means all is well or there are no mentoring needs in general. In fact, it can be particularly effective to have mentoring sessions when everything appears to be fine to discuss what is going well and how can it be made even better! During meetings, mentees should be clear as to whether they are seeking specific advice, needing a sounding board, looking for detailed information, providing updates, communicating successes, or something else to ensure they get what they need from the time. Likewise, mentors should attempt to provide what the mentee is seeking, be generous with encouragement, be mindful of power dynamics, and avoid being judgmental.

One area that is lacking, but improving, is formal training on mentoring for mentors. Mentor training provides a framework for effective mentoring and can also provide valuable tools for handling more difficult issues such as students in crisis or mental health. If you have the opportunity, I strongly encourage formal mentor training.

Another benefit for the mentee is the possibility of the mentor serving as an advocate for them at opportune times. If the mentor/mentee relationship has been effective, the mentor should be able to articulate the successes of the mentee and, equally important, how the mentee faced and overcame adversity.

Finally, collegiality, dependability, follow through, and respect for each other's time goes a long way in fostering an effective partnership.

Mentoring is an investment in people and our profession. There is a generous return on this investment in the form of students earning undergraduate and graduate degrees and a talented workforce that makes significant contributions to society.

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Mentoring can happen any time, such as when you're in French Guiana traveling to a remote field site as shown here with Dr. M. Francesca Cotrufo (right) and her mentee Dr. Jenny Soong.

Early Career Members

Effective Mentoring

by M. Francesca Cotrufo

Mentoring is a significant activity in academia as well as in other professional settings. However, most of us do not receive training on this aspect, and mentoring becomes an activity that we learn as we go. In this month's column, Dr. Cotrufo shares advice on how to be an effective mentor.

Curiosity to explore the unknown and drive to advance understanding typically motivate us pursuing a career in science. When I started my career, mentoring was not on my radar as an activity that I would spend much time on, and certainly, I did not expect mentoring to become a strong passion and source of highly meaningful rewards. However, after many years in this profession, I believe that effective mentoring brings the most profound and lasting benefits to science and society. A mentor should advise as a topic expert, help the mentees in managing a work–life balance, prepare them to advance to the next career stage, and help them to establish a professional network. How can mentors be effective across this diverse set of objectives?

Establish a Relationship

Proper mentorship establishes a unique relationship that helps mentees discover their own motivations, future expectations, personal life balance, and how to achieve professional independence. To foster these relationships, mentors must first listen but also share their own passions, goals, and experiences of both success and failure. Mutual respect and clear expectations are the key ingredients for the relationship's success. Yet, we all have our own personalities, and some relationships are challenging. Mentors must recognize whom they can work with and try to attract these mentees to their lab. However, sometimes the best person for the work may not be the easiest to work with. With time

and wisdom, using a good dose of self-knowledge of their own limits, effective mentors learn to establish productive relationships with a broad range of personalities.

Take the Time

Mentoring does not work through deadlines. Mentors should not only engage with their mentees a few hours before an abstract, manuscript, or proposal deadline. Effective mentoring occurs through frequent and regular one-on-one and lab group meetings. The world moves fast, and so do our mentees; they cannot wait days to receive an answer to their emails and weeks if not months for edits on their manuscripts. Surely, mentors also have limited time and are not always available to overly needy mentees. Effective mentors arrange their own time and adjust the size of the lab group to be productive in their own work, but also to stay fully engaged with the mentees and dedicate them the time they need. Time has both quantity and quality; mentees need both. Fortunately, any time works. My best mentoring experiences have been on long drives to field sites and during countless hours working side by side in remote research stations.

Sharing Your Passion, Ideas, and Network

The enthusiasm of our mentees undoubtedly motivates us to go to work in the morning. The reverse is true too. Our mentees need to feel our passion for research and be part of our thinking process. Brainstorm ideas with mentees, listen to their (often of out-of-the-box) thoughts, and incorporate them in the idea-refining process. All of these things enrich their experiences and help them mature as scientists. Similarly, invite mentees to participate in your class, engage in outreach activities, and come to conferences with you, where you should introduce them to your network of colleagues. Mentors are the door to their mentees' academic career: make it wide-open and exciting to pass through!

Don't Expect Your Mentees to be Like You

The most frustrated I have ever been with a mentee was with my first one. As I was complaining with my former mentor, she advised: "Don't expect your mentees to be as you were." This was the most useful mentoring tip I have ever received. Each mentee is different from his or her mentor and from other mentees and requires a specific mentoring approach. Effective mentors should make the effort to get to know each mentee as a person and target their mentoring approaches and expectations accordingly. This approach becomes even more important now that many mentees will pursue careers outside of academia. An effective mentor needs awareness of the different and changing mentoring needs and the flexibility to meet them.

Mentoring Never Ends

An effective mentor is for life. If there is a field where the wisdom of experience is still appreciated, it is in research and academia. As we have gone back for advice to our best mentors throughout our career, so our mentees will continue to need us. Being an effective mentor means staying in touch with your former mentees, making sure they know they can always count on you. It is a great joy for me to get together with my former mentees at meetings around the world, be there to support and advise them as they advance in their careers and lives, brainstorm with them new ideas, and continue working with them. Effective mentoring is passed on and improves through generations of academics.

Mentoring Individuals in a Lab Group

All academics maintain the goal to establish their own research programs and grow the size of the lab group. Mentoring proves more challenging in a larger group, not only because of the time demand, but also because of the more complex network of relationships. In the group, it is important to make each mentee feel unique, yet not "different" from the others. Effective mentors should set expectations for each to contribute to the progress of the group and allow mentees to share their experiences and learn from each other. In a well-functioning large group, mentoring efforts are distributed. This enriches everybody, with the junior lab members learning mentoring skills, and the seniors, including the principal investigator, refining their skills through the continued new influx of mentoring styles and approaches.

Leading by Example

As with parenting, words of wisdom fall short if they are not demonstrated by consistent behavior and actions. My mentors did not worry about mentoring because honestly, it just wasn't a focus at the time! Some were amazing scientists and people, and others less so. Yet, I learned from all of them, watching them and reflecting on their actions. Our mentees do this too. Mentoring occurs all the time and sometimes is even most effective when we do not realize it. The most effective transfer of passion for research, work–life balance, collegiality and inclusiveness, respect, and work ethic occurs through everyday examples. As mentors advance in their careers and have fewer opportunities for all of the above, the effectiveness of leading by example, fortunately, grows stronger. In my experience as a mentee and a mentor, setting an example remains the most effective mentoring strategy.

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Students

The Informal Art of Mentorship in Grad School

by Martin Battaglia and Rachel K. Owen

Mentorship is one of the most important factors ensuring student success (Lechuga, 2011). On paper, mentorship seems like an easy process: (1) identify mentor/mentee, (2) establish mentoring relationship, and (3) get career advice to land your dream job. Often, however, the process is not so straightforward and simple. Whether you are the mentor or mentee, the relationship does not usually start with a conscious decision to serve in that role. Ask yourself the following questions—Who do you go to for writing advice? When you are applying for a scholarship, who reviews your application? Do you have good connections for career success upon graduation? When you are struggling to balance school, research, and well-being, who is the first person you call? Each of these individuals are likely serving as your mentors. You probably know them from a variety of experiences, and they are likely from different backgrounds and at various career stages. Are there less experienced students in your department that come to you with these same questions? You may be serving as a mentor to them in an informal capacity.

Guidelines for Being an Effective Mentoring Partner

While every mentoring relationship looks different, you and your mentoring partner could benefit from formalizing your relationship. Once you have identified a mentor or mentee, here are some general guidelines for being an effective partner.

1. Set the goals and objectives for the mentoring program. To ensure clear and effective communication from the beginning, determine which skills should be gained from the experience, how often you will meet with your mentee/mentor, and how you will stay in touch.

2. Get to know your mentee/mentor as a unique human being. Ask him or her about passions, hobbies, etc. You can build both a strong professional and friendly relationship.

3. Lead by the example. Make sure to be always on time and well prepared before a meeting. Be professional and always act with integrity: Honesty, confidentiality, and good manners are fundamental values.

4. In the end, everything will be fine; if it is not, then it is not the end. As a mentor, share your stories of struggling (in life and academia) with your mentee, providing enough detail on how you overcame those hard times. Being a new undergraduate or graduate student can be intimidating… surely one of the most challenging times in our professional life. Make sure to support your mentee during tough times.

5. Mentorships should always encourage both academic and personal growth. Teaching some of the leadership skills you gained in your time as a grad student (i.e., how to deliver a quick 30- to 45-second elevator speech; being intentional with the people you want to meet at a meeting; following up with your network contacts regularly; becoming involved with the different leadership opportunities available with the three Societies, etc.) will make a big difference in the professional life of your mentee.

6. For research conversations, focus on the "why" rather than the "what." To improve education, we need to convince teachers and parents of the importance of children's "why" questions (Olson and Loucks-Horsley, 2000). The Next Generation Science Standards released in 2013 (www.nextgenscience.org) advocate for the use of *scientific inquiry* in science. Instead of asking about what the effect is of using factor A and factor B at a given level on the variable under study, present the results of a given experiment with a very concise list of the materials and methods utilized, and simply ask, "Why did this happen?" or "What could have been done differently?" Both mentors and mentees will benefit from discussing the scientific process and how to improve their research.

In conclusion, do not underestimate the power of mentoring relationships. Mentorship is beneficial for all involved but can be particularly effective for underrepresented populations of students in STEM and agricultural sciences. Numerous studies have cited mentoring relationships as one of the most important factors retaining women, racial minorities, and first-generation college students in STEM disciplines through graduation (Griffin et al., 2010). Mentoring becomes even more important to ensure success in advanced-degree programs. Act early to identify gaps in your mentoring needs, and be quick to mentor upcoming students in your discipline.

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A Framework for Mentoring Students Attending Their First Professional Conference

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Abstract

Scientific conferences build professional skills and identity in undergraduate students and provide opportunities for developing professional social skills, a sense of belonging to their field, and an understanding of potential career options. However, undergraduate student attendance at professional conferences is low. When undergraduate students do attend, they often express anxiety associated with speaking with professionals, networking, or with the conference environment. To address these concerns, instructors from several institutions collaborated to develop an undergraduate course with the objective of training students to attend their first professional conference and then traveled with them to experience a conference. The course framework involved meetings with students and course assignments before, during, and after the conference. Assessment results indicated that student outcomes included a greater sense of belonging to their profession, social benefits, gains in confidence, career confirmation, and an improved understanding of the pathways to pursuing a career in this field (i.e., importance of undergraduate research, gaining experience during college, etc.). Our results suggest that formal preparation for attendance at a national scientific meeting maximizes the potential for students to benefit from their experience and reduces the anxiety many students express about attending a professional conference.

Core Ideas

- Undergraduate students benefit by attending conferences and interacting with professionals.
- Active mentoring and support before, during, and after a conference increases student confidence.
- Students gained a sense of belonging, social benefits, and career confirmation through the course.
- Developing professional relationships likely leads to increased retention of professionals.
- This mentoring course focused on students in natural resource and environmental sciences, but the course structure is easily transferrable to other disciplines.

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Scientific conferences provide many professional, academic, and social opportunities for students. Academic (i.e., workshops, contributed paper topics) and professional (i.e., resume review sessions, career panel discussions) opportunities may vary between different conferences or subsequent years of the same conference, but a common element of all conferences is social opportunities. Social interactions experienced during professional conferences can enhance students' involvement in their field, lead to long-term retention of professionals by developing new relationships and strengthening existing relationships, improve students' motivation, and increase their sense of self-efficacy (Jones et al., 2011), which is the belief of students in their ability to successfully perform a behavior (Bandura, 1997). Professional socialization has shown to increase self-efficacy support in students attending conferences (Helm and Bailey, 2013), and increases in self-efficacy and confidence have been identified as important factors in persistence of students in science, technology, engineering, and math (STEM) fields (Graham et al., 2013). Furthermore, interactions with peers who share similar interests and aspirations as well as the formation of social networks likely strengthen a student's professional identity as a future professional in their field (Hunter et al., 2007), also leading to retention or persistence of these early career professionals.

Although undergraduate students may benefit from the opportunity to develop professional relationships, many undergraduate students, especially those not involved in research, do not attend these conferences. Many undergraduate students express anxiety associated with socializing professionally and with their unfamiliarity with the professional culture. Mabrouk (2009) found less than half of undergraduate students attending the American Chemical Society meetings participated in organized social activities. To overcome this anxiety and to maximize students' experiences at a conference, additional mentoring and support would be beneficial as they prepare for and participate in a conference (Mabrouk 2009). A structured approach to guiding a student through their first conference

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Abbreviations: PU, Purdue University; STEM, science, technology, engineering, and math; TWS, The Wildlife Society; UNCW, University of North Carolina Wilmington; WVU, West Virginia University.

is similar in concept to the structured undergraduate research programs that mentor and lead students through their first research experience. Importantly, these research programs report significant gains in personal and professional outcomes for participating undergraduate students related to networking and socializing (Lopatto, 2004; Hunter et al., 2007; Russell et al., 2007; Adedokun et al., 2012).

To encourage students to attend a conference, provide support throughout the event to reduce anxiety, and optimize the students' experiences, instructors at three institutions collaborated to develop and offer a course that prepared students for their first professional conference. The course provided students with an opportunity to attend a national conference with continued support and structure throughout the conference experience. The overall course objectives were to (1) provide students with an opportunity to attend a national meeting; (2) provide consistent mentoring and support before, during, and after the conference to formalize the experience; and (3) support students during the development and re-evaluation of their career goals.

MATERIALS AND METHODS

Course Overview

We developed this course primarily for undergraduate students at all levels in their academic program; however, graduate students have enrolled in the course to maximize their experience at professional conferences as well. The course had an enrollment ranging from 10 to 14 students at each of the three universities and was offered in wildlife ecology and environmental sciences programs, although the course could easily be adopted by any academic program. At each university, the course had a primary instructor or team of instructors and in most cases, a graduate student who served as both a teaching assistant and as an additional mentor to the students enrolled in the course. For our courses, enrolled students attended The Wildlife Society's (TWS) annual meetings in Pittsburgh, PA, in 2014 and Raleigh, NC, in 2016 for the conference experience.

We divided the course structure into three main modules: pre-conference, during conference, and post-conference. During the pre-conference portion of the course, students met with the course instructors and graduate student mentors three to six times for group discussion and completed a series of course assignments. During the conference, students met with the instructors and graduate mentors daily to debrief and discuss their accomplishments. In 2014, students also met with guest speakers during the daily meeting to discuss the variety of pathways to a professional career. In 2016, students from the three participating universities met both with their course instructors and mentors and then with instructors from a different institution. After the conference, students and instructors met one or two additional times to debrief about the overall experience and students completed a final assignment.

Attending a conference can be expensive because of travel costs and conference registration. The total cost of attending the conference was included within the syllabi and discussed during the first course meeting with the students. All students understood they would be responsible for covering the cost if they enrolled in the course. Instructors also worked with the students and student organizations to write grants and raise funds to reduce the cost for the students. For the 2014 Purdue University (PU) course, all of the students' costs were covered by grants and support raised by the students and instructors. During the 2016 course at PU, West Virginia University (WVU), and University of North Carolina Wilmington (UNCW), students were responsible for approximately 50% of the overall cost of attending the conference. We minimized travel and housing costs by carpooling to the conference and students sharing hotel rooms.

Pre-Conference Course Activities

During the three to six pre-conference course meetings, students completed a series of six to nine assignments (Table 1), depending on the course instructor and institution. The goal of these assignments was to prepare students to maximize their experience at the conference by reviewing the conference schedule, investigating the potential people attending the conference, and building professional skills. Another goal associated with these assignments was to familiarize students with the conference format and structure and prepare them for socializing professionally in an attempt to reduce anxiety. The initial assignment was an intentions essay to encourage the students to begin thinking about what they hoped to gain by enrolling in the course and attending the conference, how attending the conference may benefit their education and career, what they thought might be the biggest challenges in attending the conference, and what skills they hoped to gain during the course.

In addition to the course assignments, students met with the instructors three to four times in a seminar-style course format to review the assignment expectations, discuss the students' work, answer questions, and provide mentoring and support before the conference. During these conversations, instructors addressed questions and provided information regarding career-specific professional social behavior including professional attire, how to approach people, and how to politely leave a conversation. Instructors also addressed conference language and structure including the differences between a plenary, symposium, and a workshop and moving between sessions to attend presentations in different rooms. We discussed safety and other considerations for visiting a larger city including traveling in groups, finding inexpensive meals, and navigating traffic. Students had the opportunity to interact with faculty from other institutions at the conference and could begin considering opportunities for future graduate programs as a part of this course. Therefore, we discussed differences between undergraduate and graduate programs, differences in thesis and non-thesis programs, and differences between masters and doctoral programs; how to contact a potential advisor and select an advisor; and how to apply to graduate school; and funding for graduate programs.

Students also were required to identify professionals attending the conference they were interested in meeting, email these people, and set up an in-person meeting. Anxiety related to socializing with strangers and professionals within their field is high for most students, so the instructor at WVU organized a mock social event, complete with snacks and beverages, that involved the Associate Dean of Academic Affairs for the college among other faculty, staff, graduate students, and administrators.

Table 1. A description of the major pre-conference assignments that were incorporated into the courses at Purdue University (PU), the University of North Carolina Wilmington (UNCW), and West Virginia University (WVU) that trained students to attend a professional conference. For each assignment, the expected student outcomes are identified as well as the institution that implemented the assignment.

Assignment	Student tasks	Expected student outcomes	Institution that implemented assignment
Intentions essay	Students wrote a 2–3 page essay summarizing their intentions for enrolling in the course and describing their desired outcomes for participating in a professional conference.	Students formalized their interests and desired outcomes for the course.	PU, UNCW, WVU
Personal conference schedule	Students used the conference app when available to develop a schedule of events they planned to attend while at the conference. Students also identified the highest priority presentations to attend.	Students spent less time at the conference searching through the schedule and arrived with a plan to optimize their attendance.	PU, UNCW
Critical evaluation of abstracts	Students selected three conference abstracts to demonstrate the range of organization of information within an abstract.	After reviewing abstracts, students gained an improved understanding of content and structure of an abstract.	PU, WVU
Create/revise a current resume	Students created or revised their resume with the intention that they could share this with potential employers or graduate advisors, or to have it critiqued at the resume help booth.	Students completed the course with a current professional resume that has been reviewed by instructors, and possibly by the resume help booth, and was ready for use when applying for future jobs.	PU, WVU
Develop questions for meeting with professionals	Students were expected to meet with others at the conference and in preparation, they developed a series of questions that they could use during those meetings.	Students arrived at the conference with questions to use during meetings with other attendees that were developed and reviewed in class.	PU, UNCW, WVU
Negotiate missed class while attending the conference	Course instructors wrote and distributed a letter for students' course instructors to describe the importance of the course and why students would be absent during the conference. Students were responsible for sharing this with their instructors, identifying the missed work, and had each instructor sign the form.	Students would minimize the impact of their absences in courses while they attended the conference and gained a clear understanding of their instructors' expectations for making up missed work and class meetings.	PU, UNCW, WVU
Identify professionals or agencies to meet during the conference	Students began the assignment with a paragraph outlining their future career interests and then created a list of three people they planned to meet at the conference with a description of who they are and why each person was selected. Students were tasked with contacting these people to potentially set up an informal meeting during the conference. The UNCW course assignment required students to develop and present a PowerPoint presentation about a person or agency likely represented at the conference.	Students would arrive at the conference with planned meetings with potential employers, graduate advisors, or other professionals who could provide career or academic advice.	PU, UNCW, WVU
Review of primary literature	After identifying people to meet, students read research papers co-authored by these people and summarized the literature.	Students would meet with professionals at the meeting with an understanding of their past research and/or management involvement.	PU, UNCW
Networking night (mock social)	Students participated in a social, organized by the instructor, that included food, beverages, and a variety of people to meet and practice networking before the conference.	Students would build confidence in navigating a professional networking event similar to the ones planned for the conference.	WVU

This event provided students with the opportunity to practice initiating a conversation with someone they did not know in a setting similar to what they would experience at the conference.

During Conference Course Activities

During the conference, we assigned students a series of 10 tasks to encourage social interactions and participation in the conference (Table 2). Each task was worth a relatively small amount of points (~1–2% of the overall course grade per question), so if a student was too overwhelmed to complete a task, it would not have a significant negative impact on their course grade. To build comradery among the students and for accountability, students were required to have a witness from the course sign their assignment sheet to vouch for the completion of the task. Finally, students were required to report a brief summary of the event during an evening debriefing session at the meeting.

Each day during the conference students met with the instructors in a meeting room secured before the conference for approximately 1.5 hours to debrief on the day's activities, have questions answered related to presentations or conversation from their day, and to hear about their classmates' experiences. During the first 45 minutes, the students engaged in conversation and discussion about the day. In 2014, we invited three guest speakers identified by the students during their pre-conference assignments. Guests visited with the group in a conversational forum, described their career pathway to their current professional position, and answered students' questions. In 2016, individual institutions met separately during the first 45 minutes for the debriefing and then mixed institutional groups during the second half of the meeting for additional discussion about their day.

Post-Course Activities

Following the conference, students met an additional one to two times to discuss the overall experience of both participating in the course and attending the conference. Following these meetings, students wrote and submitted a 2- to 3-page reflection essay summarizing their experience. Essays addressed such questions as whether attending the conference and participating in the course were worthwhile; whether the experience was different from what they expected and what were the biggest surprises; what advice would they provide to students attending a future meeting; did the experience confirm their career goals; what was their biggest challenge and their biggest reward; and if there was anything the instructors could do to improve the student experience in the course or at the conference.

Table 2. Students were provided with a task sheet with assignments to complete during the conference. Different instructors used a combination of these (not all instructors used all of the tasks listed below). When they completed each task, students were required to write a brief description of the event, record the time and date of the event, and have a witness (another student from the course) sign verifying completion.

Task	Description of event	Time/date	Signature of witness
Meet another undergrad member from a different institution			
Meet a grad student from a difference institution			
Meet a nonacademic professional			
Meet a professor from another institution			
Ask a question of someone at a general research poster			
Ask a question of a student at a research in progress poster			
Ask a question at the end of a talk			
Meet alumni at the alumni social			
Attend another activity (vendors, panel discussion, plenary session, non-Purdue social, etc.)			
Attend a working group meeting			
Meet a TWS Council Member†			
Meet an Executive Board Member			
Attend the Quiz Bowl			
Speak with a vendor about their products			

† TWS, The Wildlife Society.

Assessment

Instructors administered a voluntary pre- and post-conference survey to evaluate students' confidence in their abilities to complete a variety of achievements or behaviors related to attending a conference using a 7-point Likert scale. This analysis allowed us to quantify changes in self-efficacy that would suggest students could envision themselves moving forward in a science career and participating in future conferences. We used matched pre- and post-conference survey pairs with a paired, two-tailed *t* test in SPSS (v. 24, IBM, Armonk, NY) to evaluate differences in students' confidence. We also evaluated the reflection essays and identified and documented major themes that emerged regarding students' perceived outcomes from attending the conference. The PU Institutional Review Board (IRB) approved all student assessments and covered students at all three institutions (Purdue University IRB no. 1508016424).

RESULTS AND DISCUSSION

Student Assessment Results from Pre- and Post-Conference Survey

Results from the pre- and post-conference assessment in 2016 suggested that the experience had a significant impact on students' confidence regarding professional socialization. Students reported a positive change in their confidence toward all surveyed tasks or behaviors with the only nonsignificant change related to their confidence developing and completing independent research (Table 3, Fig. 1).

Student Feedback

In their first course assignment (the intentions essay), all students enrolled in the 2016 course at PU noted that one of their main reasons to enroll in the course was to develop professional networking and social skills. However, ~50% of the PU and 78% of the UNCW students also recognized that speaking with professionals and building the confidence to approach people was going to be one of their greatest challenges. Nearly 33% of the students in 2016 noted that they hoped to strengthen connections with peers, graduate students, and faculty at their home institution. Other common reasons to enroll were to learn how to attend a conference, develop career connections, explore their career options, investigate graduate school opportunities, meet with specific people or organizations, and learn more about their favorite species, region, or research focus. Several students (<15%) seemed overwhelmed by the idea of attending a large conference and expressed concerns about scheduling their time and time management, navigating the conference, the number of people that would be present, and the amount of information they would process over a short amount of time.

In all iterations of the course, students reported in their reflection essays that attending the conference was an overall positive experience. In fact, 43% of the UNCW students specifically stated the course met or exceeded their expectations. Many of the benefits they reported involved building confidence and developing a sense of belonging in the profession, which is similar to the survey results (Table 3). More than 75% of students reported that the experience confirmed their career choice and their decision to attend graduate school, although at both WVU and UNCW, one student realized that wildlife conservation might not be the right career choice. Additionally, students who had not been considering graduate school reported a new interest in research and pursuing a graduate degree and gained a better understanding of the process for pursuing graduate school. Again, similar to the results from the survey (Table 3), students gained confidence interacting with professionals while often reporting that the initial thought of this was "scary." Despite this concern, students were surprised at how friendly, supportive, and positive the professionals and other students were during these interactions. Students also noted that they enjoyed hearing about new technology, research, and opportunities that were available to young professionals and felt energized observing the passion people expressed toward their careers.

Although negative comments and feedback were rare, a few students (~20%) acknowledged that they felt overwhelmed and tired during the conference. Others noted that it was often difficult to initiate conversations at socials because professionals also were busy socializing with old friends and colleagues, and students were unable to step into the conversations and ask them questions about their

Table 3. Results from a paired, two-tailed *t* test analyzing undergraduate students' confidence in completing tasks related to conference attendance or professional developing before and after attending a professional conference, The Wildlife Society's annual conference in Raleigh, NC, in 2016. The sample size was 26 for all questions, except networking with professionals (n = 25). All changes in students' confidence were positive.

Survey question	Test statistic	*p* value	Cohen's *d*
Developing and completing independent research	1.266	0.210	0.242
Presenting research findings in either poster or oral presentation format	5.047	<0.001	0.880
Starting conversations with professionals	5.196	<0.001	1.137
Speaking about current challenges facing wildlife populations	4.2	<0.001	0.839
Networking with undergraduates from other universities	5.091	<0.001	1.155
Networking with professionals	4.359	<0.001	1.047
Acquiring a graduate or professional position after graduation	2.519	0.019	0.636

research or career. One student was disappointed in the low diversity in the plenary speakers. Finally, many commented it was difficult to budget time to various opportunities.

In 2014, 100% of PU students found the course beneficial to maximizing their conference experience; in 2016, 91% of the students at PU and 100% of the WVU and UNCW students thought the class was beneficial. Students commented that the course forced them to talk to people and participate in the conference. They noted that if they had not enrolled, they likely would have been less engaged and missed opportunities. This requirement also helped them gain social confidence and networking skills. The assignment to develop a personal itinerary (Table 1) was often cited as the most useful pre-conference assignment because it prepared them to immediately participate in conference activities. Some appreciated the opportunity to evaluate and discuss abstracts whereas others found the requirement to read papers before meeting with professionals increased their confidence during the meeting and provided topics for discussion.

Social benefits were an outcome students commonly acknowledged. Students noted that course participation and conference attendance allowed them to develop new friendships and strengthen existing relationships with other students and the course instructors from their institutions. Students reported that the presence of their professors and instructors at the conference made them feel more comfortable in the professional setting, knowing that they had them as resources and for support. Students often commented on the anxiety and fear before attending the conference, but that the course helped reduce these feelings and made them feel better prepared to maximize

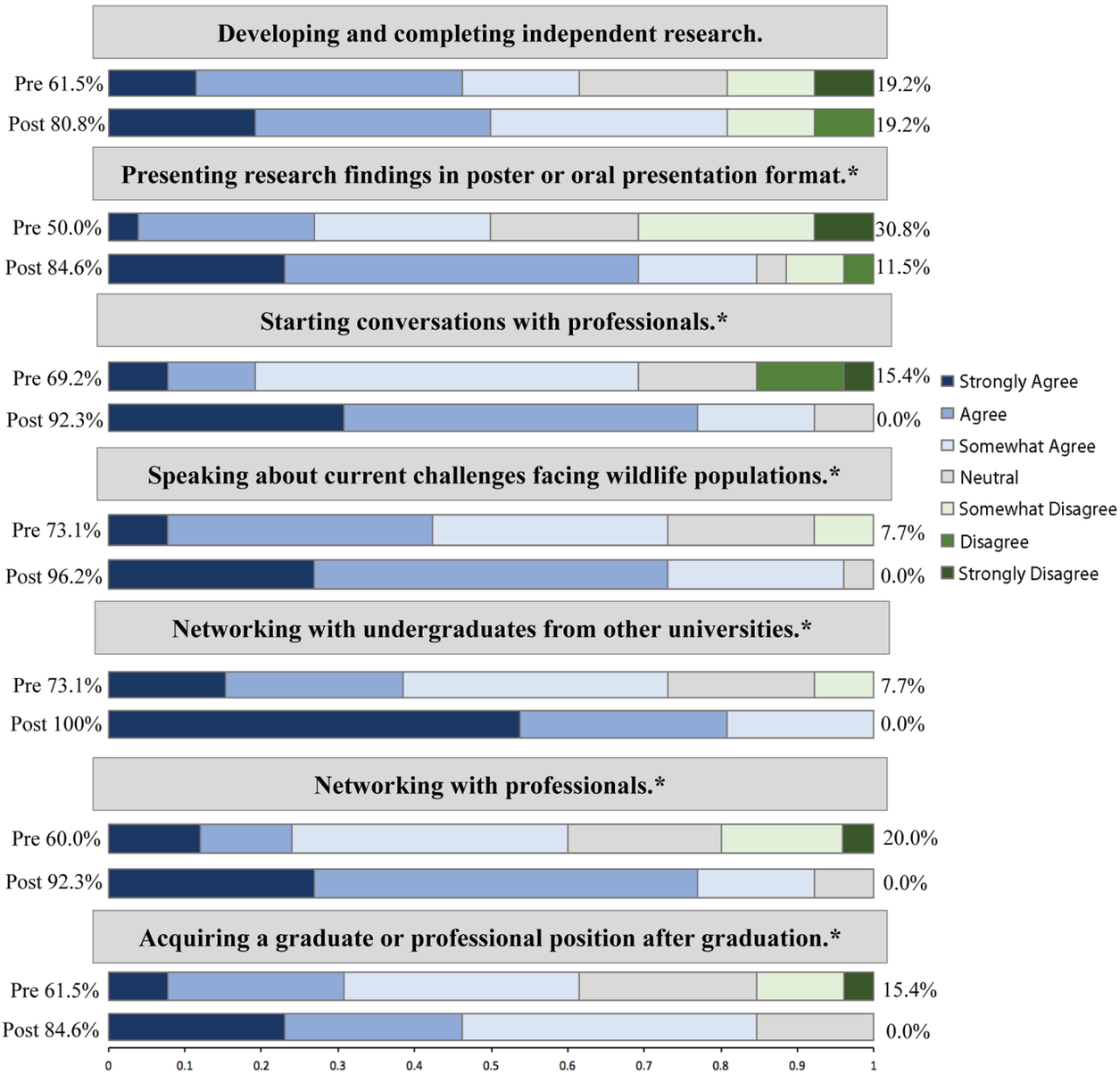

Fig. 1. Results from a pre-conference (upper bar for each question) and post-conference (lower bar) survey question for students enrolled in a course to prepare them to attend their first professional conference. The sum percentage of all levels of agreement and disagreement are listed to the left and right of each bar, respectively. A total of 26 students enrolled in three sections of the course offered at Purdue University, University of North Carolina Wilmington, and West Virginia University in 2016. The survey used a 7-point Likert scale to assess students' confidence in accomplishing a variety of tasks related to attending a professional conference. *Indicates significance ($\alpha = 0.05$).

their experiences. Students who had attended a conference before enrolling in the course noted that they gained much more from the overall experience than from their first conference experience. Finally, many noted that they appreciated the 10 assignments during the conference (Table 2) because it required them to do things they likely would not have done, including approaching and meeting people, without this requirement.

Students provided some suggestions for future iterations of this course in their reflection essays. Most agreed that the pre-conference assignments were helpful. Students also suggested that instructors encourage students to attend sessions with a classmate or require everyone to attend plenary or keynote sessions to facilitate discussions during the class meetings. The 2014 students were very positive about the daily meetings at the conference and seemed to benefit from the guest speakers. The 2016 PU students were less positive about the daily meetings but did note they benefited from the discussions because it allowed them to learn about topics they missed, boosted their confidence, and provided an opportunity to compare undergraduate programs from different universities. The 2016 PU students also complained about the witness requirement for the conference tasks, citing this as a barrier to completing assignments. The UNCW and WVU students did not express concerns regarding the witness requirement, indicating that cohorts may respond differently to this task based on the cohesiveness of their group. The 2016 students also requested more interactions among the university groups.

Instructor Feedback and Observations

The conference preparation and training course was a rewarding experience for the instructors and allowed them to introduce students to their professional society, colleagues, and professional culture. Overall, the instructors and graduate teaching assistants agreed with the students' feedback that it was a positive experience. The instructors observed that the structure of the course was beneficial in allowing students to gain an understanding of the experience and ask questions before they traveled to a large city and were immersed in a conference with >1,800 attendees.

The meetings with students during the conference also were critical in that they provided a safe place for students to discuss both their positive and negative experiences during the day and receive feedback and support. Students also used those meetings to ask questions related to presentations they saw, most often questions related to statistical analysis, and many reported that they heard a talk during the day that incorporated methods they had recently learned in a course. Instructors observed that students' expectations for the conference to be "scary, intimidating, or overwhelming" did not, in most cases, meet reality. Once students forced themselves to network, those expectations were quickly replaced (albeit with a few rare negative experiences). Instructors also observed an increasing level of confidence expressed by the students as the conference progressed, with students asking more questions and providing increasingly critical evaluations of presentations, likely because of the support system provided by the course and the daily feedback during the course meetings. Two PU students presented their undergraduate research in a poster session and appeared to greatly benefit from peer support during this experience.

Future course iterations will maintain similar structure and assignments because of the documented student outcomes.

Instructors will continue to pair the on-campus course with the mentored conference experience. Without the course structure and support, our personal conclusion, based on observations and having attended many conferences with students before this course, is that students in this course benefited to a greater extent in terms of maximizing their professional social interactions than if they had attended the conference without participating in the course.

CONCLUSIONS

Overall, the course outlined here was successful in providing students with a supported and mentored professional experience and in training them to attend their first conference. The course structure appeared to significantly influence the students' experiences and led to four major outcomes for our students including developing a sense of belonging, understanding professional social behaviors, gaining confidence in themselves, and confirming their career plans. Nearly all students and all instructors reported positive experiences and all students who participated reported that the course helped maximize their experience at the conference. The students found the assignments and pre-conference course meetings helpful in preparing them for the conference and reported that the daily meetings during the conference provided important feedback. Although this iteration of the course focused on students in natural resource and environmental sciences, the course structure is easily transferrable to other disciplines.

There is clearly a need to provide more opportunities for undergraduate students to engage with their professional community and to develop and practice professional social skills (Hunter et al., 2007; Kneale et al., 2016). Attending professional conferences is one way to train young professionals while allowing them to explore opportunities available to them in their future career and build stronger relationships with their peers, faculty, and staff from their home institution. While undergraduate research experiences provide students with similar benefits, those experiences are restricted to a relatively small proportion of the undergraduate student population. Courses like this can provide a larger number of students with a transformative social and personal career experience, increase student participation in undergraduate research opportunities, and improve retention in our professions.

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