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Co-Mentoring Undergraduate Research: Student, Faculty and Institutional Perspectives

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The Institutional Climate

Elon University is a comprehensive liberal arts institution that prides itself on being a teaching institution that values scholarship as a way to inform teaching and recognizes the importance of mentorship in the traditional roles as faculty. The Elon Teacher-Scholar Statement (original 2003, mentoring added 2008; Vandermaas-Peeler, Miller, & Peeples, 2015) grounds and guides our work and articulates the synergies between teaching and scholarship. Recently, in a memo to faculty at Elon University, Provost Steven House (2017) wrote,

> "**The teacher-scholar model** – With teaching as the primary focus of the Elon faculty, we have committed to a model that holds in balance the practices of teaching and scholarship, explicitly including the related work of mentoring. The teacher-scholar model embraces the **both-and** tension (that is, not **either** teacher **or** scholar, but **both** teacher **and** scholar), recognizing the valuable outcomes that emanate from that tension...Elon's uniqueness is not in any one thing that we do or how well we do it, but rather how we embrace the work of balancing all of these constructive tensions, as well as how we engage together in the work of enhancing a university relentlessly focused on academic excellence and student transformation. Herein, too, lies our shared responsibility to nurture a community where all can flourish."

Not only is there a stated value to this commitment at Elon University, but there is also a resource commitment with funding supports for faculty and students. Specifically, Elon has faculty research and development funds and course releases for which faculty can apply, and faculty are also given reimbursement or the ability to bank time towards course release for mentoring independent undergraduate student research through course credit. In addition, there are programmatic supports that foster a community of mentors and scholars for both faculty and students (e.g., Undergraduate Research Program (www.elon.edu/urp), Lumen Prize Program (www.elon.edu/lumenprize), and Honors Program (www.elon.edu/honors)).

It is with the institution's priorities towards excellence in mentoring that the three authors have engaged as dyads in co-mentoring relationships for several years. Co-mentoring is defined as the intentional relationship where it is assumed that both mentors have something to contribute and to gain from being in this relationship. There is a flattening of the power structure such that all points of views are valued with little fear of evaluation and judgment from the other colleague (Nicholson et al,

2017; Mullen, 2000). Colleagues therefore, mutually work to help each other flourish along the various stages of their career path.

Weaved through this paper, we highlight more recent and intentional efforts by Ketcham and Hall, who started co-mentoring six years ago and helped achieve recognition for formalized co-mentoring relationships at our institution in programs that had not previously recognized it. Our co-mentoring began with individual student projects and eventually expanded into a Research Institute of Elon BrainCARE (www.elon.edu/braincare). About four years ago, we both were engaged as participants in a Center for Engaged Learning (CEL) Research Seminar on Excellence in Mentoring Undergraduate Research (http://www.centerforengagedlearning.org/cel-seminars/), in which Miller was a co-leader. This experience allowed us in part to look at this model together and with colleagues from multiple institutions in a more formalized way. Furthermore, two years ago we had an honors student, Sara Corning, who successfully applied for the Lumen Prize for a project that we were, at the time unofficially, co-mentoring. This led to conversations with both the Honors and Lumen directors who because of some of our current institutional boundaries, asked us to propose a more formal model which we will discuss in this paper.

We will thus start by addressing the institutional benefits and challenges around co-mentoring and use our formalized co-mentoring model as the context for discussion. We will then present a practical guide to co-mentoring, including incorporating salient practices of mentoring undergraduate research (Shanahan et al., 2015). We will discuss some qualities and characteristic of co-mentoring, thus creating a climate for success that are the responsibility of each faculty member involved. Finally, we will conclude with the benefits and outcomes of a co-mentoring model for students, faculty, and products from the research.

Institutional Benefits of Co-Mentoring

There are many benefits of co-mentoring that serve an institution and its mission (see Table 1). One of the main elements of co-mentoring relationships is that they can foster an ethos of collaboration at the departmental, college, and institutional levels. These collaborative relationships may help units within the institution accomplish strategic initiatives and build successful programs. This work is better supported when stakeholders begin with an orientation toward working together rather than in isolation. A potentially important effort to support the development of a collaborative department is to have discussions of mentoring and collaboration as prominent pieces of the interview process. When these discussions are incorporated into the hiring process, departments that value collaboration can assess if a candidate fits the department in this context. Candidate "fit" has been identified as one of the most important hiring characteristics when selecting a candidate (Landrum & Clump, 2004). It also allows the candidate to consider how important this characteristic is for them as well. Another prominent institutional benefit

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of co-mentoring is the potential for faster and more successful socialization of younger colleagues (Cawyer, Simonds, & Davis, 2002). By helping faculty enter into co-mentoring relationships, the potential for mutually beneficial gains increases (Allen, Poteet, & Burroughs, 1997; Cawyer et al., 2002; Johnson, 2016). Through these dynamics, faculty may be able to receive feedback more regularly and thus, be able to develop their skills and abilities to be successful. This is likely beneficial not only for faculty new to the institution but also for those wishing to reinvigorate their

careers. Faculty are then both contributors and beneficiaries of the "co-learner" characteristic of mentoring relationships proposed by Kram and Hall (1995).

Of course, it is particularly important that these efforts align with departmental and/or institutional priorities and values in order for them to be successful. However, these dynamics can also support the development of priorities and programs that support success in all faculty roles. Faculty may experience increased research productivity, such as papers, presentations, or performances, but also feel the impact in their roles as academic advisors, teachers, and university leaders/servants. In fact, the development of new models of mentoring may help foster faculty creativity which, in turn, may pay dividends for the students enrolled in these areas (Johnson, 2016).

Ultimately, it is hoped that by engaging multiple viewpoints into a project, the project will rest on a more solid and well-rounded foundation, allowing its progress, related gains (i.e., student learning, faculty career success, etc.), and future directions to be more holistic. On a grander scale, it is possible that these relationships could support the development of large and sustained interdisciplinary collaborations. It is conceivable that co-mentored research efforts can provide the catalyst for creative and successful collaborations in other areas of the faculty's professional lives.

Institutional Challenges to Co-Mentoring

In addition to the benefits of co-mentoring for an institution, there are also inherent challenges that must be considered and navigated in order to best realize the benefits (see Table 1).

Table 1

Benefits and Challenges of Co-Mentoring for Institutions

Benefits to Institutions	Challenges to Consider
• More and larger developmental networks • Supports an ethos of collaboration • Establishes departmental and institutional culture • Increases productivity for all faculty roles (teaching, service, & scholarship) • Supports community and career satisfaction • Enhances organizational commitment • Potential benefit for faculty searches/hiring & retention • Talent development for faculty and student • Alumni loyalty: Stronger mentoring network enhances the value felt by students • Assists in scaling of mentored experiences • Development of novel, interdisciplinary projects and collaborations • Fosters connections with other types of experiences • More holistic approach to a research question	• Budget tensions - compensation models can be tricky and likely need flexibility • Efforts need to align with institutional mission, strategic plan, & annual priorities • Provides models of successful co-mentoring but allow space for new/different models • Assessment of the impact all told (educational, faculty career, student career, alumni, etc.) • Resists these communities becoming insular • Supports robust collaboration and community development • Engages mentors in communities of practice • Offers opportunities without being prescriptive • Articulates how mentoring supports faculty evaluation and success • Tensions may arise when faculty are divided on the value of mentoring

The biggest institutional challenge is in regard to compensation and budget. Typically, mentored undergraduate research programs are created with a one-to-one student to mentor model in mind. Often, mentor compensation is split between the mentors of record so that faculty and students choosing to engage in such a dynamic can be supported. However, it may be unlikely that simply

splitting mentor compensation evenly between the mentors truly reflects the energies that go into making this enterprise a success. This characteristic may underlie some of the biggest hesitation for widespread support across programs with mentoring components. It is important that faculty acknowledge both the benefits and demands of such a model and enter into it with full recognition of its nuisances. It also means that this approach should not be mandated by the institution, but rather, supported when appropriate. So, even when a co-mentored model is recognized as valuable and meritorious, it may not fit cleanly into existing compensation models and existing budgets. This leaves us with a question of what is adequate compensation for all mentors involved.

As we navigated co-mentoring at our institution, the biggest challenge that we faced was gaining institutional recognition as co-mentors for our work. After Sara Corning, an honors student, was awarded the Lumen Prize, we reached out to the directors of the Lumen Prize Program and Honors Programs to legitimize our roles as co-mentors, but they were resistant at first. Writes Ann Cahill, Professor of Philosophy and Director of the Lumen Prize,

> "After Ms. Corning had received the Lumen Prize, Dr. Ketcham contacted me to inquire about the possibility of co-mentoring Ms. Corning's Lumen project with Dr. Eric Hall. I was, I must admit, hesitant about such an arrangement, and communicated my concerns to Dr. Ketcham (namely, that Ms. Corning might not receive the same consistent attention that she would receive with an individual mentor, and/or that the co-mentors would end up doing even more work, collectively, than an individual mentor would, and would not be sufficiently compensated). Dr. Ketcham listened to my concerns respectfully, and then just as respectfully disagreed with them, with a directness and clarity that I found admirable. As our conversations continued, I became convinced that such a model would be possible, but I also required Dr. Ketcham, Dr. Hall, and Ms. Corning to come up with a two-year plan that delineated precisely the responsibilities of all three of them on a semester-by-semester basis, and a detailed defense of why the co-mentoring model would best serve Ms. Corning's interests. (Such a plan was necessary to assuage my first concern; while Drs. Ketcham and Hall were, to be frank, uncompelled by my second, I have sought and will continue to seek ways to ensure that their compensation as co-mentors is as fair as possible.) The plan that they came up with was striking in its level of detail and thoughtfulness, and convinced me that the co-mentoring model was not only feasible, but, in this case, preferable."

Tom Mould, Professor of Sociology and Director of the Honors Program was supportive of our work co-mentoring Sara Corning, but he was hesitant about how to operationalize it for the program and others who may want to co-mentor. We developed a model for him to consider. Mould explains some of his initial concerns:

> "In most cases, I have been wary of co-mentoring because of concerns captured in common adages such as 'too many cooks spoil the broth,' or the dangers of a 'servant to two masters' (abhorring the language of the final quote but finding the sentiment powerful). When students find their research interests falling somewhere in between two faculty, their solution often turns to asking them both to mentor their project. With no clear guide, responsibilities too easily risk falling to the wayside, placing an unfair burden on a well-meaning student asked to navigate relationships and expectations far beyond their control.

> However, the co-mentoring model that Eric and Caroline have developed helps ensure the hazards are minimized, and the benefits maximized. Crucial to their model, I believe, is that the two faculty already have a clear, established working relationship conducting research together. In this way, a student enters an already healthy research relationship, and can benefit greatly."

After the three summers of work through the CEL seminar, we were better equipped to tackle issues around the intentionality of co-mentoring (Nicholson et al., 2017) and to come up with best practices (Shanahan et al., 2015) for co-mentoring. As part of the rationale for co-mentoring, we initially created a table highlighting the benefits for students and faculty in co-mentored relationships. We were asked to also include the challenges so that others who might try to enter similar relationships knew what to expect. From our work with these directors, we developed Table 2.

Table 2
Benefits and Challenges of Co-Mentoring for Students and Faculty

Benefits to Students	Shared Benefits
• Gaining more than one perspective on the research • Utilizing complementary strengths of faculty mentors • The ability to carry out multi-disciplinary research • The ability to engage with interdisciplinary research questions • The ability to draw on technical support • The greater likelihood of publication as a result of faculty investment of time and of robust research design resulting from multiple perspectives • Employability skills deriving from team working • Transferable skills such as managing multiple inputs of ideas and perspectives	• Intellectual support • Professional socialization • Personal support • Emotional support • Real – world working scenario • Increased productivity • Learning new research techniques • Gaining a third perspective on the research project • Socio-cultural humility • Identity growth • Creation of a liminal space to break down traditional power structures
Benefits to Faculty	**Challenges to Consider**
• Authentic and ongoing feedback • Observations of mentoring practice • The ability to observe another person's mentoring practice • Academic dialogue about mentoring • Academic dialogue about a new research area • Ongoing collaborative research after the end of the project • Blending of research and teaching activity rather than them being seen as antagonistic • Time savings in terms of professional development being embedded rather than separated • Advocate statements for promotion and tenure	• Need for more intentional planning of research project • Time to coordinate meetings • Acknowledging and working past stylistic differences • Making sure communication is always including all parties • Mentors being on the same page or working out differences so the student is not caught in the middle • Time for drafts to be reviewed by both mentors • Putting fear of judgment about mentoring or scholarship aside • Putting ego – your way is correct – aside • Being willing to voice and work through conflicts as they arise • Having realistic expectations of work load (mentoring is not half the work even though compensation is half) • The recognition of mentoring is not equal, but both mentors need to acknowledge, value, and voice the work of each other when appropriate

Another major concern is how co-mentored experiences align with institutional values, priorities, and missions. Elon is a learning-centered institution and we have been very intentional in showing how co-mentoring has the students' best interests in mind while also allowing faculty to be successful. At other institutions, with different missions and priorities, co-mentoring may not be a desirable approach to student and faculty engagement, as success may be assessed using very different criteria and metrics. Another challenge from an institutional perspective may be who "gets credit." Some institutions place high value on author order or product ownership. In that approach, co-mentoring may not be valued and, in fact, could limit faculty success and serve as a disincentive for this type of arrangement. We have found our ability to successfully articulate the power of this work and partnership to be well-received by others on campus. In addition, our work has been recognized for its high quality and as an equal collaboration in the broader field. This has been important for supporting one another for promotion, tenure, and recognitions at our institution and beyond.

Practical Guide to Co-Mentoring
Mentoring student research is an intentional process that takes significant faculty time and work. Faculty engaged in student research mentoring ultimately view this work as integral to their teaching, scholarship, or possibly both. But there are challenges that need to be overcome for successful projects to develop and for the students to gain the benefits associated with this high impact practice in higher education. Co-mentoring changes the process in that there are more faculty involved. Therefore, there are multiple voices and perspectives that need to be incorporated to ultimately benefit the work and the student experience.

Phases of Undergraduate Research Process
In Table 3, we have taken the 10 Salient Practices of Mentoring Undergraduate Research (Shanahan et al., 2015) and put them into a co-mentored context. Specifically, we highlight the positive aspects of co-mentoring, as well as particular pieces that must be coordinated and communicated between faculty members so that at no time is the student the messenger between faculty members. Below, for each phase of a student research project, we have put the number that relates to the specific salient practice in parentheses and then discussed it in a co-mentoring context in more depth.

Project development (1, 2, 3, 6). Helping students explore ideas and interests within the context of your larger expertise is valuable and important in the development of a young scholar. This helps students foster an interest and begin taking *ownership of their work*. Co-mentors are guiding this navigation and helping with questions about feasibility, relevance, and development of research ideas, but student interest and passion development are going to be essential for making the project happen. This should be incorporated and intentional in the *pre-planning* and exploration phase of the project. During this time, the co-mentors should begin *scaffolding expectations* for the project. This also tends to be a time of growth and uncertainty for students, so balancing *emotional support* with *rigorous expectations* begins in this phase and should be done by each of the co-mentors.

Developing scholar (3, 4, 5, 6, 7, 8, 9). In this phase, students know the questions they want to ask and it is the job of the co-mentors to foster the development of their skills and passion. There are many ways to do this, including weekly *one-to-one mentoring meetings*, helping teach and learn *technical skills*, attending conferences, engaging in journal clubs, presenting progress, etc. All of these represent the effort to model the *disciplinary and scholarly norms*. In a co-mentored project, the development of a scholar incorporates multiple views, *wider networks* and different scholarly experiences from the start. In this phase, co-mentors need to provide support and guidance, but also allow students to make mistakes and solve problems. For example, while co-mentors may provide edits to work, students need to intentionally take that feedback, reflect, and improve the writing. Just making the edits will not help them grow as scholars. This continual process gives them confidence in, and *ownership of*, their work.

Table 3

Ten Salient Practice of Mentoring Undergraduate Research (Shanahan et al., 2015): Co-Mentoring Models

1	Do strategic pre-planning in order to be ready to respond to students' varying needs and abilities throughout the research process. • Be very clear with student about the role of each faculty member and the varying levels of overlap. Strategic planning of project should include both mentors and student. Student should see all faculty as a mentor at equal levels and seek advice from whoever is convenient/comfortable, most relevant to question (via expertise), or both. It should be clear that faculty will communicate with each other constantly.
2	Set clear and well-scaffolded expectations for undergraduate researchers. • A syllabus for each semester and an ongoing timeline. This is essentially a beginning point for the team, but helps student know expectations from co-mentors will be consistent and unified. This model should strengthen support and not make expectations confusing.
3	Teach the technical skills, methods, and techniques of conducting research in the discipline. • Each faculty member will help with their expertise and be involved in all aspects of research methods conversations to highlight multiple perspectives and academic discourse.
4	Balance rigorous expectations with emotional support and appropriate personal interest in students. • This is an ongoing process for all involved. The expectations need to be clear and co-mentors need to communicate on strategies to support and build both individual and team relationships with student and fellow mentors.
5	Build community among groups of undergraduate researchers and mentors, including graduate students, postdoctoral fellows, and any other members of the research team. • This becomes part of the model with constant communication modeling and networking. The goal is to meet as a team as often as possible with the understanding that it is not always possible, but mentors will communicate next steps and outcomes so it is not the onus of the student.
6	Dedicate time as well to one-on-one, hands-on mentoring. • Meetings will be weekly as a team and one-on-one as needed. E-mail communications and shared folder will include all to keep communication seamless.
7	Increase student ownership of the research over time. • This will be natural in the process and because of ongoing perspectives from more than one mentor, the student will be pushed in directions that may take them out of the comfort zone but help them grow tremendously. For example, we have varying presentation styles but respect each other immensely and those not only help our student grow, but also grow as a mentor.
8	Support students' professional development through networking and explaining norms of the discipline. • Two perspectives and discourse between mentors give a realistic view of the field and the range of norms. In addition, the academic lineage and pathways will be much more diverse.
9	Create intentional, laddered opportunities for peers and "near peers" to learn mentoring skills and to bring larger numbers of undergraduates into scholarly opportunities. • Because we are a co-mentoring model, we expect this will take on a graduate lab feel with students at multiple levels and faculty helping oversee and navigate - sometimes a bit more hands-off. This will prepare students for professional and academic graduate program settings.
10	Encourage students to share their findings and provide guidance on how to do so effectively in oral and poster presentations and in writing • Disseminate and get very comfortable writing and presenting with ownership of own style because mentors have varying feedback. More like the real peer-review process

Note: As an aside, this model helps faculty professional development by being able to observe another

mentoring style and get feedback on their own style. This is a very open and dynamic relationship that promotes growth, development, and collegiality all which are vital to a vibrant career and career satisfaction in the sciences.

Emerging scholar (4, 7, 8, 9, 10). The ultimate success is when students find their flow in the research process and emerge as a collaborator and promising scholar in the field. At the end of the research process, with the help of the co-mentors, the students should have taken *ownership of the research* and know it in-depth because of the different expertise of their co-mentors. The student will have opportunities to present it to peers and at conferences, building confidence and ownership, but may have more options on where to present based on the background of their mentors. Having two mentors may also open up different potential *professional networks* of which to become a part. The differing points of views of their co-mentors may help the student begin thinking about how to incorporate their research experience into their career goals and next steps, as well as, to prepare for peer review submission. They are able to integrate and translate this experience into qualities and characteristics that they value and that help them to achieve future goals. The co-mentors may begin to view students as peers and have them take on potential *mentoring of younger students* in the project or lab. While research may not be the end game for many students, this process will be part of who they are, how they think, and how they interact with others. The process of *fostering their passion* is ongoing and mentors are instrumental in helping them navigate this process through reflection and guidance. The hope is that the students have a high impact and transformational experience with two life-long mentors.

Climate of Co-Mentoring Experience

Faculty ultimately define the climate of the research experience for students and this comes with responsibility. In a co-mentored experience, there is an additional relationship between the faculty members that also plays into this climate. This relationship must be solid and secure and thus requires each faculty member to be aware of the responsibilities they have in making it a positive experience. We have identified some qualities of each individual that are likely the key to a successful experience, and have highlighted topics to consider as a team before engaging in the process and that should also be revisited often throughout the experience. Co-mentoring places a responsibility on faculty members to be leaders in setting an open, honest, and supportive environment. Here are some aspects to consider in creating this climate.

Academic pace. It is important to have some sense of each co-mentor's work ethic and capacity, while finding compatibility with one another's pace. Co-mentors should have frank conversations about this and what each other's expectations are for the experience. From here, the ebbs and flow of work capacity for each mentor will vary depending on competing personal and professional responsibilities and challenges. This give and take has to be embraced, appreciated, and communicated. It is not the day-to-day happenings that have to be balanced but rather the larger view of contributions to the project. This requires that individuals are not 'bean counters' but rather have the ability to be perceptive of needs and capacity of each other and be willing to adapt and communicate with one another.

Communication and trust. Micromanagement will not work in a successful co-mentored experience. Colleagues have to respect the leadership of each other and communicate regularly. While making time to meet and work together is important, many things just need to get done. Co-mentors should be free and expected not only to take turns leading and making decisions but also to communicate, keeping the other informed. Never should students feel they are the mediators between mentors. Projects will move in unexpected directions. It takes trust in each other and the process to let projects evolve.

Plan—reassess—update plan. Co-mentors should find time to make a road map each year for the larger overarching goals as well as individual project goals and then take time to regularly reassess. Each mentor has varying views of priorities, strengths, and the "just have to get it done" list. Talking through those items, distributing leadership responsibilities, and planning for them when not at an emotional boiling point is essential. This plan should be written in pencil as opposed to pen, reassessed, and updated often.

Publishing. The ultimate goal of research is the dissemination of the results. Co-mentoring involves a process that may often lead to messy products, integrating multiple styles and perspectives. Having one person polish it up for consistency and then submitting to get external feedback early, and sometimes often, leads to meaningful feedback and growth in ideas. Communication about roles on the paper and authorship order probably needs to happen early on in the process although these may be adapted as the projects evolve. The inclusion of students as co-authors should also be discussed early on in the process and a plan for this should also be determined by the co-mentors. This will hopefully set expectations and prevent any major issues arising in the process.

Championing co-mentors. It is important to be a vocal advocate and supporter of your colleagues. Co-mentors and their collaborative work may be recognized by colleagues, students, and outside collaborations, but assumptions may be made by others about whose work it "really" is. It is imperative that colleagues continually inform others of the shared and equal contributions that are made by the co-mentors. This may be especially true for co-mentoring relationships where one or more members are part of historically disadvantaged groups in academia (e.g., women and faculty of color) or where there are institutional or structural power differences (e.g., seniority and chair). Being clear about contributions to a project is important to communicate between each other and to colleagues outside the collaboration. This partnership requires co-mentors to support their colleague's professional goals and could involve nominating and writing letters of support for promotion and other accolades.

Qualities, Characteristics, and Responsibilities of Individual Co-Mentor
Creating a space where a positive climate is achieved also requires each individual to bring in characteristics and practices that support this environment. To be direct, co-mentoring is not an "easier" model or appropriate for the "lazy" scholar who wants to just tag onto projects of a productive scholar. This partnership takes work, just like any relationship where personal or professional capital is at stake. Co-mentoring should be considered for those who want to deepen the learning experience for all involved and value modeling a mindset of grit and growth (Duckworth, 2016, Dweck, 2006). While the risks may seem high, the rewards are worth it. These are some characteristics we have identified and the literature supports as being important in nurturing a successful co-mentoring climate.

Sidelining fear. There are numerous fears that should be considered when entering into a co-mentoring relationship: fear of judgment, fear of failure, fear of being caught as an academic imposter are all potentially part of our individual DNA. However, as professionals we need to be able to put aside these fears or talk through them for the benefit of all involved (Hutchings & Rainbolt, 2017; Knights & Clark, 2014). This is true for not only the relationship between mentors, but also for the larger project and healthy modeling of academic discourse and growth mindset for students. This model requires that the group meets as a whole, and if one mentor is paralyzed by one of these fears or creates barriers to moving the project forward, then the experience will not be positive.

Emotional intelligence and ego management. We all have them, egos, and the role of how they play out in a co-mentoring model needs to be monitored, sometimes contained, but often should be acknowledged (Hutchings & Rainbolt, 2017; Knights & Clarke, 2014: Mayer & Salovey,

1997). For a co-mentoring experience to be effective, no one mentor should be identified in the group as the primary mentor and credit should always be shared or acknowledged when appropriate. This requires each mentor to be honest with what they have contributed and acknowledge the contributions of each other. Egos are funny things that, if not stroked at certain times and at other times contained, can create feelings of inequity and lack of respect.

Adaptability. This in many ways is an ability that can be developed and requires strong disciplinary knowledge, acceptance of vulnerability, and flexible thinking (Krogh, Bearman, & Nestel, 2016). While space for longer reflection and idea development is always important, in co-mentoring, you also have to be able to listen to other's ideas, integrate them into your disciplinary knowledge and expertise, and dialogue about your view in real time. Sometimes your colleague or the student, may have perspectives or expertise that challenge your thoughts or ideas, and you have to quickly integrate that knowledge or acknowledge that you need to do more background research. This models flexible thinking and academic discourse that are important to the scholarly process in which students are engaged. It helps break down power structures and create a collegial and collaborative environment.

Intellectual risks and boundaries. Because co-mentors may have different disciplinary expertise, the individuals must be willing to take intellectual risks and pursue broader and more complex questions in an effort to help achieve the greater project goals (Twale, Ridenour, & Schaller, 2005). Many times these risks pay off, but it is a team risk and communication needs to be constant to keep ideas and possibilities moving forward and theoretically grounded. As you move toward topics in the boundaries of your expertise, you have to explore the literature and role model integrating this information into your project. Intellectual risk taking is rewarding in collaborative contexts, but requires trust and continual adaptations and adjustments.

Mutual vulnerability, growth, and grit. In the context of mentoring undergraduate research, the student (mentee) is usually the most vulnerable. In a co-mentoring model, mentee and mentor roles shift continuously. This means that there will, and should be, times when each member is vulnerable. Ideas may be shot down or feelings may need to be validated. Modeling and engaging in this liminal space is one of the most important components of individual and team growth. This process should be respected and understood to be sacred, especially between colleagues. There should be continued reciprocity so that all members benefit from growing and helping others grow within this safe space. This process supports revisiting critical feedback and helps to deepen the mutual gains inherent within mentoring relationships for all stakeholders (Duckworth, 2016; Johnson, 2016; Mullen, 2000; Nicholson et al, 2017; Sorcinelli & Yun, 2007).

It is important to speak up if you are feeling inequities in the co-mentoring relationship for any reason. Similarly, it is important to listen to and hear the other person's concerns and refrain from becoming defensive. The balance of work, power, and leadership is constantly shifting. This fluid dynamic needs to be embraced by both co-mentors. Otherwise students will feel the tension and their learning may be negatively impacted as a consequence. This is not a healthy co-mentoring relationship and can result in detrimental outcomes both personally and for the project.

Benefits and Outcomes of Co-Mentoring

As we have put forth a practical guide and discussed faculty responsibilities for success, we do think it is important to highlight the benefits and outcomes of a strong and solid co-mentoring model. Currently we co-mentor multiple students annually, mostly as part of Elon BrainCARE Research Institute. In addition, we both engage in other scholarly activities and single-mentored experiences with the same expectation of high quality outcomes.

From our collaboration and co-mentoring over the last six years we have co-edited a book on concussions, co-authored 14 peer-reviewed publications (seven with student co-authors) and presented over 50 papers at regional, national, and international conferences (not including undergraduate research forums). We have hosted four symposiums and been consultants, collaborators, and co-investigators on multiple grants. Our students (21 graduates and counting) have gone on to top graduate programs (e.g. M.S., Ph.D., M.D./Ph.D., M.D., D.P.T., N.P., O.T.). Most of these BrainCARE alumni continue to incorporate the research process into their career development with many focusing on concussions in their clinical training. While we have had many accomplishments as a collaborative team, we have also found individual success and accolades as teacher-scholar-mentors. Having a supportive colleague to push us to pursue each new professional opportunity and provide friendship through personal challenges is a valued byproduct of our collaboration.

This has been and continues to be an experience for both of us where the benefits both personally and professionally far outweigh the challenges. We have been very thoughtful and continually engaged in discussions about qualities, characteristics, responsibilities, and practices that make this a successful endeavor. Our path has not been without challenges, many of which were averted quickly by engaging in an honest and open conversation when either of us needed it, and the respect to listen and reflect together to navigate an effective path through. Having a common goal of helping each other flourish is always central to these conversations.

While it is easy to think that a co-mentoring model is beneficial to students, we felt like it would be appropriate to include a few quotes from some of our current and former students who have been exposed to the co-mentoring model. The first comes from Sara Corning, Exercise Science major, Lumen Prize recipient and Honors student, Class of 2018.

> "Being co-mentored to me has been very instrumental to my research project in that having multiple resources is immensely valuable. It has also allowed me to explore different aspects under one overarching topic because I have the mentors that can support me from their personal expertise to further my project in different ways. It also helps to have more minds brainstorming ideas and ways to approach research; while trying to figure out my methodology, it has been helpful to have two different inputs guiding me with my research."

> "My experience with co-mentoring allowed me an opportunity to assimilate multiple viewpoints into a project and ultimately gave more depth to the research I was conducting."

Kelsey Evans, Exercise Science, Class of 2014 (currently a M.D. student at East Carolina University), writes:

> "My experience with co-mentoring allowed me an opportunity to assimilate multiple viewpoints into a project and ultimately gave more depth to the research I was conducting. It set me up well for graduate level research where multiple advisors assist with a project and have many different contributing factors. I think co-mentoring allowed me to grow as a learner and researcher and taught me how to incorporate different ideas and think outside the box."

Additionally, Mark Sundman, Exercise Science, Class of 2012 (currently a Ph.D. student at University

of Arizona), states:

> "Co-mentoring breaks down traditional power structures and shifts the dynamic whereby the students feel like they're part of the team – like they have a seat at the table. Rather than simply doing what they're told with little afterthought, they may feel more comfortable thinking critically and bringing new ideas to the table. In addition to becoming more invested in the project, the students benefit immensely from the process of critically evaluating these new ideas and the professors may similarly benefit from the perspective of a relative outsider. As a former undergraduate mentee in this environment, I felt uniquely prepared for the next step of my career. I was equipped with the confidence, social skills, and practiced curiosity to feel comfortable voicing new ideas without feeling discouraged when they didn't stick."

The development of the mentee in these relationships is reiterated by Graham Cochrane, Neuroscience major, Class of 2015 (currently a M.D./Ph.D. student at University of Alabama-Birmingham) when he says:

> "Something that I found very worthwhile from both of you mentoring me was seeing how you both interacted as professional colleagues. With a single mentor, I think the mentee runs the risk of seeing the mentor's opinion as the end-all-be-all of projects. I think being able to see how you two constructively challenged each other made me confident that I could bring up my thoughts on the direction of our projects as it felt like a more collaborative environment. I think I've carried that confidence into my other mentor-mentee relationships and have a much better idea of how to present myself respectfully but still get my opinions across because of observing Dr. Hall and Dr. Ketcham."

Conclusion

In this paper, we have outlined the benefits and challenges of co-mentoring for students, faculty and institutions. We hope that our perspectives from one institution can help others as they consider entering into co-mentoring relationships. There are several components to consider and work through as a team, and it will not happen overnight. However, with intentionality and open discussions between mentors and of course with students, there are numerous beneficial outcomes.

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