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Improving mentored research relationships

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A challenging part of an academic's job is developing productive research relationships as a mentor. This paper presents ideas for improving a mentor's effectiveness at different mentorship phases, from the relationship's initiation through its redefinition upon graduation. These ideas stem both from personal experiences with undergraduate and graduate students and from a review of relevant literature.

1. BACKGROUND

This article stems from a talk given at the 178th Meeting of the Acoustical Society of America, in a special session entitled "Mentoring Graduate and Undergraduate Students." The session was sponsored by the Education in Acoustics and Women in Acoustics Committees and the ASA Student Council. The session grew out of discussions between co-chair Professor Dan Russell and me about how we could become more effective mentors and how we could promote mentorship within the Society. Although there is a broad and deep body of literature dedicated to mentorship of college students,[1] the fundamental purpose of this paper is to describe ideas for improving the different phases of a mentored research relationship.

This is not my first article on mentoring and will hopefully not be my last, as it is an area in which I hope to continue to improve and contribute. After an article[2] describing the state of acoustics education at Brigham Young University (BYU) and team-based research groups, colleagues and I authored an article[3] about preparing for an academic career by learning to how to mentor research students. This paper discussed some lessons learned, including a) setting a scholarly goal at the outset of a research program, with specific result-driven milestones and clear expectations of the "end game," b) adopting a management style that is best suited to each student's personality, c) adapting the project where possible to student strengths, and d) helping them learn to write as early as possible. The paper also discussed how graduate students can be trained to become effective peer mentors of undergraduate students, increasing both a sense of teamwork and overall productivity.

These initial papers led to an opportunity to coauthor an article[4] in *Acoustics Today* with Art Popper. For that article, a more serious review of the mentoring literature led to a greater understanding of mentoring relationships and their natural phases. Enhancing writing ability and publishing productivity through mentoring was the subject of an additional Proceedings of Meetings on Acoustics (POMA) article.[5] For this paper, I attempt to describe the four phases of a mentoring relationship and present ideas of how these relationships can be improved through deliberate, purposeful mentoring.

2. MENTORED RESEARCH RELATIONSHIPS

In an oft-cited publication on mentoring, Kram[6] describes four stages of a mentoring relationship that are applicable to mentored research. These phases are inevitable parts of the academic relationship, and may be summarized as follows:

Initiation begins as a student is recruited and consists of initial training, defining a research project, and concrete research objectives.

Cultivation is the focus of an academic mentoring relationships. In this phase, the student acquires skills and knowledge and disseminates this knowledge in publications.

Separation is a transitory phase that occurs in tandem with a student's thesis defense and graduation.

Redefinition refers to the post-separation phase in which the mentor and mentee become closer to peers.

3. IMPROVING INITIATION

Initiation commences the mentoring relationship, and begins with recruiting. When I meet a prospective research mentee, I have first found it helpful to understand the student's motivation: are they simply looking for a job or class credit or are they genuinely interested in some particular research area. Second, I try to ascertain the student's skills, whether prior coding experience or construction or data analysis. Third, I try to understand the student's academic level, in particular any understanding of acoustics, and math classes taken. Finally, I try to understand the anticipated level of availability and commitment. These four questions help me form an initial plan for a project and anticipated scholarly outcome, identify required initial training, and to set expectations regarding project pace. In most cases, I am seeking students to assist on sponsored research projects with external research sponsors or to perhaps augment their scope.

Initiation can last several weeks or months, depending on the student level. One of the key elements of Initiation is to begin two-way communication of values and vision. If I do a poor job of establishing a dialogue that establishes mutual expectations, clarifies project needs, sets specific goals and a clear path for reaching those goals, then the mentoring relationship is likely to struggle. One of the things I need to do better is to provide the student with a basic list of written expectations that we can discuss, modify if needed, and revisit from time to

time. Part of these expectations needs to be a discussion regarding the nature of external funding, which can mean deadlines, reports, various levels of confidentiality, and the withholding of funding if satisfactory progress is not being made.

It is likely, that despite efforts to communicate regarding expectations, project scope, goals, and anticipated outcomes, which include the mentee's personal and professional development, there will be some challenges caused by a mismatch in mentor and student expectations caused by differences in prior experience. This can be particularly true if the student is a research novice or if there are differences caused by race, ethnicity, and gender.[7] For example, Davidson and Foster-Johnson[8] describe how essential mentoring is for graduate students of color to help them become integrated into an unfamiliar department culture and how important it is that the mentors understand issues specific to the preparation of a culturally and ethnically diverse population of graduate students. However, the authors detail a number of issues that often arise. Regardless of the cause(s) of challenges, an early evaluation and a reboot of vision, expectations, and goals is often necessary – even after a few weeks. This early feedback mechanism allows the mentor to clarify miscommunications and helps the student ask questions based on the new experiences.

In summary, Initiation can be improved through a) clear communication of objectives and anticipated outcomes that creates a mutually-understood vision for the mentee's development while completing research, b) written expectations that describe how to achieve that vision, and c) some goals that help the student begin to develop into a semi-independent researcher. Noting possible cultural and other differences in experience will be helpful in providing early feedback that will set the mentor and mentee on a path toward Cultivation.

4. IMPROVING CULTIVATION

The aim for any research mentoring relationship is to make Cultivation – the productive time in between Initiation and Separation – be as long and as effective as possible. During Cultivation, the mentee acquires knowledge and experience and develops a vision for their long-term personal and professional development. This development is aided by further defining the mentoring relationship structure, such as meeting frequency and organization and discussing measures of progress and their tracking.

A. GRADUATE STUDENTS

To track progress, regular performance reviews are essential. These reviews serve various purposes including motivating mentees, providing overall direction, refining intermediate and long-term goals, communicating student challenges, and receiving feedback regarding the mentoring environment to resolve conflicts. I have a formal performance evaluation at the end of each semester with my graduate students (three times per year) where we review academic performance, discuss long-term plans, evaluate progress toward meeting current goals, and set new goals to accomplish the research objectives and meet thesis deadlines and publication schedules. Each evaluation lasts around 45-60 minutes. I would benefit from trying to provide the same performance evaluation structure with my undergraduate students; their meetings are frequent but less formal and they often focus on big-picture career questions outside of research questions.

Another way of improving Cultivation for graduate students is to encourage the establishment of a meaningful graduate committee that can help expand the student's network of mentors. My PhD dissertation committee, in particular, consisted of experts that lent valuable insight and provided feedback that helped me improve my research and critical thinking skills. Moreover, my advisor mentored me to seek help from those in the research area. Consequently, I contacted experts in my field at several universities and research laboratories who provided me needed direction and support and later became familiar, friendly faces at conferences.

The mentor distinguishes himself from the advisor by actively helping the student develop needed research and professional skills. I attended multiple conferences during my MS and PhD degrees and was encouraged to write journal articles early on. Clarity in communicating science is often a challenge and Kloepper offers some suggestions for mentors and teachers looking to help their students develop this important skill.[9] More specifically, technical writing can be quite difficult for students, and in a recent article,[5] I offer some experience and literature-based insights into how conference proceedings articles (such as POMA) can be used to help students publish early, overcome writing-related anxiety, and have a productive Cultivation stage.

B. UNDERGRADUATE STUDENTS

For undergraduate research assistants, Cultivation can be a relatively short phase of the mentoring relationship. These students are usually new to research and often new to a significant mentoring relationship,

and are ill-prepared to receive the benefits of this relationship. Thus, the expected outcomes of Cultivation must be kept realistic. I have been fortunate to work with more than 60 undergraduate students on research and many have published papers and gone on to earn graduate degrees. I still have much to learn, but I believe success in mentoring undergraduate students can be attributed to a) mentee motivation, the formation of mentoring-forward (i.e. hierarchical[10]) and team-based mentoring environments with graduate students, and the establishment of a culture with an expected scholarly product.

A hierarchical mentoring relationship is one where undergraduate students are in part mentored by a graduate student or postdoctoral scholar who is also being mentored by the faculty member. This type of relationship may help the undergraduate receive more attention and progress more quickly, but it also benefits the junior mentor. In an interesting study by Dolan and Johnson,[11] they collected surveys from graduate/postdoctoral mentors who worked with undergraduate students. These mentors' initial motives for taking on an undergraduate student were relatively narrow, focused on their enhanced productivity by having a research assistant. However, graduate/postdoctoral mentors usually derived less research productivity gains than expected. Instead, they reported a wide range of other gains, including

- improved qualifications and career preparation
- cognitive and socioemotional growth
- improved teaching and communication skills
- greater enjoyment of their own apprenticeship experience.

The gains and challenges they reported indicated a longer-term vision of how mentoring influenced their personal, cognitive, and professional growth. I have found this to be true with my own graduate students. However, I point out one area of caution. I have found that when it comes to teaching students to use hardware and software, I need to regularly insert myself into the training process. Otherwise, over time, students passing information to other students becomes like a game of "Telephone." (For the comic that inspired this moment of insight, see http://phdcomics.com/comics.php?f=1994)

5. IMPROVING SEPARATION AND REDEFINITION

Separation is the intended result of an academic mentoring relationship. Separation is typically a stressful time in a student's life, with thesis and graduation deadlines, manuscript submissions, job searches and offers, and moving. As a mentor, I also feel stressed for many of the same reasons, but also feel the stress of ensuring results, codes, data, etc. are documented and accessible so as not to be lost. The stress can also be related to the loss of an important cog in the mentoring environment, as the student is most productive and capable just before Separation. Consequently, as Separation approaches, regular communication is essential to ensure the "end-game" is clearly described to avoid surprises. For example, I am trying to put more emphasis on documentation of codes and organization of results along the way, so as to not cause as much stress at the end. Stress is also reduced if primary objectives are clearly established during Initiation and revisited throughout Cultivation. This helps eliminate potential conflict about when a student is "done" and the mentoring relationship is ready for Redefinition.

In Redefinition, the mentor and mentee move from an expert-novice relationship to closer to a peer relationship. In Redefinition, the mentor can serve a valuable role, providing career advice, references or nominating letters long after the initial mentoring has concluded. The mentor and mentee may form new research collaborations. But one of the challenges in forming a redefined mentoring relationship is the failure to complete manuscripts related to the research. Students mistakenly believe they will be able to quickly wrap up and submit manuscripts after leaving but very rapidly they find that what they could accomplish in the matter of a few hours during their degree program can now take weeks. I have, unfortunately, allowed students to make this mistake time and time again. But, this is what makes communication so important as Cultivation approaches Separation.

6. MENTAL HEALTH AND MENTORING

Like many professors and research mentors, I have seen an uptick in students struggling with mental health in the past several years. There is an increasing body of literature that describes the stress and overwhelmed feelings students encounter.[12] Given the nature of research and the other student responsibilities, debilitating stress, depression, and anxiety can strike during any phase of the mentored research relationship. Evans *et al.*[13] describe how a 2014 study showed that 43% of bioscience graduate students were depressed and that graduate

students are six times more likely to suffer from depression and anxiety than the average population. Female and transgender students were particularly susceptible. Another study by Hyun *et al.*[14] described a survey of 551 international graduate students that showed 44% had had an emotional or stress-related problem that significantly affected their well-being or academic performance within the past year.

In light of such daunting statistics, how can I best help students to simultaneously pursue research excellence and emotional resilience? Other than being aware of counseling and other resources on campus, seeking to be a supportive, effective mentor can have a significant impact. Evans *et al.*[13] indicate that supportive and positive mentoring relationships correlate significantly with less depression and anxiety. Likewise, although mentorship is not explicitly mentioned, Hyun *et al.*[14] found that more functional relationships between international graduate students and advisors were less likely to report having an emotional or stress-related issue and seeking counseling services.

7. SOME ADVICE FOR MENTEES

The purpose of this article has been to provide some suggestions for would-be research mentors. However, I conclude with some advice for would-be mentees. I call these the "4 R's of Menteeship":

- **Responsibility:** The mentee should be willing to take responsibility for his or her progression, and be willing to be evaluated and challenged along the way
- **Respect:** A mentee should respect the efforts of the mentor to help him or her excel, which should serve as a powerful motivator to work hard
- **Relationship:** Because novice mentees are often ill-prepared to benefit from a mentoring relationship, they need to consciously seek to learn the key elements and benefits of mentorship
- **Recharge:** It is important that significant periods of stress be followed by some time to recharge and refocus, otherwise the student's motivation and mental health may eventually suffer.

As a product of conscientious mentorship and a would-be lifelong student of mentoring principles, I am hopefully passing along some lessons to the next generation of students that will inspire them and empower them to become mentors themselves.

ACKNOWLEDGMENT

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