

5. Striving for Excellence in Mentoring Undergraduate Research:

The Challenges and Approaches to 10 Salient Practices

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Mentorship is a defining feature of undergraduate research (UR). As more colleges and universities strive to meet student demand for authentic scholarly experiences, it is imperative to know what effective UR mentors do and how to address the most challenging aspects of mentoring. In this chapter, 10 salient practices are explained and illustrated with authentic examples. We also explore key implications of those salient practices, such as which are most challenging to carry out and why, and how mentors in different contexts are doing so successfully. Based on participant data from UR mentoring workshops, as well as surveys and interviews of mentors in various disciplines and institution types, this chapter describes ideas for implementing the 10 salient practices and ends with implications for faculty development.

UR has changed dramatically in the last decade, in its definitions, contexts, models, and structures. Most notably, mentored scholarly work by undergraduate students has spread well beyond the laboratory sciences to every academic discipline, expanded from one-on-one and small-group mentoring to include course-based research experiences, and grown in diverse institutions of higher education around the world. What has remained constant through its evolution, however, is a primary defining characteristic of UR as “mentored” work (Kuh 2008; National Academy of Sciences 1997; Osborn and Karukstis 2009; Wenzel 1997). The promise of UR as a high-impact practice that promotes student success depends on the quality of the mentoring relationship (Bowman and Stage 2002; Hensel 2012; Ishiyama 2007; Jones and Davis 2014; Mekolichick and Gibbs 2012; NAS 1997; Linn et al. 2015; Pfund et al. 2006). As Osborn

and Karukstis (2009) explained when defining “undergraduate research, scholarship and creative activity,” *mentorship* has remained one of the “unifying features” of the practice for at least two decades. Mentors of students’ scholarly work are much more than research supervisors; they are highly engaged collaborators who are also guiding students’ deep learning and development. It is that deep learning that makes UR one of 11 high-impact practices, or HIPs (Kuh 2008; Center for Engaged Learning 2016).

Brownell and Swaner (2009, 26) argue that the “high impact” of UR and other HIPs “could potentially be greater when colleges and faculty take the time to design these experiences carefully, paying attention to each piece of planning and implementation.” This chapter seeks to contribute to that effort, helping faculty mentors design, plan, and implement UR experiences that offer the highest impact for their students. We focus on mentors’ practices as a means of advancing UR’s impact for two main reasons: the preponderance of evidence that effective mentorship is essential to successful UR (Hensel 2012; Shellito et al. 2001) and the claims of students across demographic groups that the most valuable aspect of their UR experience is their relationship with their mentor (Falconer and Holcomb 2008; Ishiyama 2007; Kardash 2000; Kendricks, Nedunuri, and Arment 2013; Mabrouk and Peters 2000). Several studies have established that good mentorship is key to successful UR experiences, but what actually constitutes effective UR mentoring across institutions, disciplines, and contexts has been less clear. Elon University’s Center for Engaged Learning (CEL) held a seminar on excellence in UR mentoring that provided the impetus for the authors to come together as a team and to explore this topic in-depth. An early outcome was a literature review of effective mentoring practices. We identified 10 salient practices of UR mentors associated with student success (Shanahan et al. 2015). Identifying the 10 practices of UR mentoring has created a foundation for campuses

and individual faculty and staff to evaluate what they do and to consider changes to their practices. The next stage has been to draw on the expertise of UR mentors to determine practical means of carrying out those practices. The Association of American Colleges and Universities (AAC&U; 2010, para. 1) noted in its *Campus Toolkit* that “intentional program design and advanced pedagogy” are critical to ensuring student learning and to narrowing the achievement gap in HIP. This chapter seeks to answer that call, offering programmatic and pedagogical models of successful UR mentoring.

A brief overview follows of the 10 salient practices of faculty mentors of UR (Shanahan et al. 2015). We describe a qualitative methodology to establish the practices that can be most readily implemented, as well as those perceived to be the most challenging to implement. Implications of these scenarios are described: why some practices are particularly challenging, and how mentors employ them successfully. Informed by participant data from UR mentoring workshops, as well as surveys and interviews of mentors across a range of disciplines and institution types, we share specific ways to implement the 10 salient practices.

Salient Practices for Mentoring Undergraduate Research

A narrative review of 20 years of literature on mentoring UR by scholars from around the world identified what effective UR mentors do (Shanahan et al. 2015). The 10 salient practices identified are evidence-based actions of effective mentors that apply broadly across disciplines, student demographics, institution types, and mentoring approaches. The practices offer a pedagogy of mentored UR that can be used to support the professional development of mentors and address practical challenges of undergraduate research-mentoring.

1. Do Strategic Pre-Planning to Be Ready to Respond to Students’ Varying Needs and Abilities throughout the Research Process.

Effective UR mentors invest time early in the process for project selection and planning, including thinking through the kinds of research questions and tasks that are suited to undergraduates and setting achievable timelines for them. Such early planning offers the opportunity to consider the wide variability in students' levels of preparation, motivation, and skills, and to customize research roles accordingly (Shanahan et al. 2015).

2. Set Clear and Well-Scaffolded Expectations for Undergraduate Researchers.

To attend to the changing needs of students at different points in the research process, mentors of UR use the same scaffolding strategies as they do in other areas of the curriculum, providing strong support early in the process and then gradually giving students more responsibility and independence (Shanahan et al. 2015). Some scholars have recommended creating a syllabus for co-curricular UR just as would be expected for courses (Abdel-Qader 2004; Mabrouk 2003). Communicating clear expectations at each stage of the research is facilitated by outlining roles and responsibilities, rules of conduct, and deadlines in learning contracts.

3. Teach the Technical Skills, Methods, and Techniques of Conducting Research in the Discipline.</>

A primary responsibility of UR mentoring is introducing students to the expectations of research in the discipline. Guiding students through the technical practices needed to support research goals is essential and can include teaching the protocols for labs, studios, or archives; helping students correctly use databases, software, or equipment; and providing training in ethical standards and safety (Benson 2002; Lown 1993; Merkel and Baker 2002).

4. Balance Rigorous Expectations with Emotional Support and Appropriate Personal Interest.</>

Surveys and interviews of undergraduate researchers across institution types have revealed that the most valued part of their experience is deep relationships with mentors. Social-emotional connections between mentors and students may contribute to the success of the research itself, as the literature has suggested that mentors who know their student researchers very well can tailor assignments and expectations accordingly, whereas the students feel safe to ask questions and are motivated to prevail when the work is difficult. Underrepresented minority (URM) students have most strongly underscored the value of a close, trusting mentor relationship—one that helps students of color and low-income students negotiate environments in which they are in the minority (Shanahan et al. 2015).

5. Build Community among Groups of Undergraduate Researchers and Mentors, Including Graduate Students, Postdoctoral Fellows, and Other Members of the Research Team.

Successful mentors practice intentional team development to foster trusting relationships among members of the group with different roles and levels of experience. Engaging the team in common interests and activities outside of research, from potluck dinners and talent shows to campus lecture series, strengthens connections so that each member of the team feels part of a community. Time invested in team meetings can save time in the long run if everyone is apprised of the process and goals, and trusts one another enough to ask for help (Shanahan et al. 2015).

6. Dedicate Time to One-on-One Mentoring.

Although many UR settings involve groups of students at various stages of undergraduate and graduate study, postdoctoral fellows, and faculty, previous authors have shown the need for personalized guidance for undergraduates. Students who meet more frequently one-on-one with their mentors have more accurate self-assessments of their skill levels and research progress, whereas students who work less directly with mentors hold higher and unrealistic assumptions

regarding their own abilities (Cox and Androit 2009). Time-intensive mentoring increased overall success in the research and students' own sense of satisfaction with the experience (Cortinas et al. 1996; Shellito et al. 2001).

7. Increase Student Ownership of the Research Over Time.

Mentors foster students' autonomy over time by providing ownership of specific tasks and explaining how they relate to larger project goals. Mentors who welcome students' opinions and ideas about work, as well as listen with patience and openness, help their students develop confidence and independence in research (Shanahan et al. 2015). González (2006) describes such practices as means of sharing power—shifting the hierarchical relationship over time to a collaboration of colleagues in which the mentor has more experience and therefore greater leadership responsibilities, but the student's needs, goals, and input are also integral to the work.

8. Support Students' Professional Development through Networking and Explaining Norms of the Discipline.

Mentors who take students to conferences and introduce them to colleagues in the field contribute in highly valued ways to students' professional development (Shanahan et al. 2015). Mabrouk (2009) indicates that students find the networking opportunities at conferences even more beneficial than the chance to present their research. First-generation and URM students report in multiple studies that one of the most important forms of assistance their mentors provided is connecting them to potential future colleagues in graduate school and/or in their career (Campbell and Campbell 2007; Davis 2007; Ishiyama 2007; Mekolichick and Bellamy 2012; Mekolichick and Gibbs 2012). The opportunities to model professional interactions and discuss further opportunities for research and/or graduate study in the discipline also have been noted as invaluable benefits of taking students to conferences (Campbell and Campbell 2007;

Mabrouk 2009; Mekolichick and Bellamy 2012). Mentors can assist with networking by facilitating formal introductions with faculty from other institutions or by inviting students to informal social gatherings with colleagues and their students.

9. Create Intentional, Laddered Opportunities for Peers and Near-Peers to Learn Mentoring Skills and to Bring More Undergraduates into Scholarly Opportunities.

UR at research-intensive and/or doctoral-granting universities often takes place in teams that include graduate students and postdoctoral fellows in “near-peer” mentoring roles. Even research groups made up entirely of undergraduates under faculty/staff mentorship are regularly composed of students at varying levels of experience and skill, with senior group members assuming some responsibility for guiding their peers. Such “laddered” groups of researchers with various levels of expertise have particular implications for faculty and staff mentors, who have been encouraged to train experienced students intentionally in mentoring skills (Mahlab 2010; Pfund et al. 2006).

10. Encourage Students to Share Their Findings and Provide Guidance on How to Do So Effectively in Oral Presentations, Poster Presentations, and Writing.

Numerous researchers have noted the importance of developing avenues for undergraduate researchers to disseminate the results of their work, indicating the essential role of dissemination in scholarship. They suggest that sharing findings with audiences of peers and experts is the best way for students to develop oral and written communication skills (Shanahan et al. 2015). Laursen and colleagues (2010) also found that understanding the processes of writing, revision, and presenting helps shape students’ sense of themselves as scholars.

Faculty Response to the Practices—Strengths and Challenges

UR has become known as a high-impact educational practice (Brownell and Swaner 2009; Kuh 2008), largely as a result of the deep learning, critical reflection, and skills of analysis acquired through research experiences (Gonyea et al. 2008; Kuh 2008). Understanding and applying the 10 salient practices may broaden participation for a greater diversity of students and open up the pedagogy of research mentoring to more faculty. The 10 salient practices identified from the literature are therefore a useful self-reflective tool—a checklist against which to evaluate personal practice. That idea prompted us to consider practices that are relatively easy to implement, others that are more challenging, and the reasons behind those distinctions.

Identifying the Strengths and Challenges</>

We chose to present the 10 salient practices of UR mentoring (Shanahan et al. 2015) at four conferences in 2016: the National Conference on Undergraduate Research (held in Asheville, North Carolina, in April 2016); the national biennial Council on Undergraduate Research meeting (held in Tampa, Florida, in June 2016); the Oxford Brookes University Learning and Teaching Conference (attended by faculty from within and beyond the institution in Oxford, UK, in July 2016), and Elon University’s CEL Conference on Excellence in Undergraduate Research Mentoring (held in Elon, North Carolina, in July 2016, with attendees from the United States, Canada, the United Kingdom, and Australia). These conferences were selected because of their focus on UR mentoring. All four presentations included an introduction to and explanation of the 10 salient practices, prior to the data collection. The length of session varied depending on the conference, with a range of 30–75 minutes. Fifty-two individuals involved in UR mentoring participated in this study. All participants completed an informed consent form approved by Elon University’s Institutional Review Board.

We asked Participants to complete a survey and open-ended questions about the salient practices. On one side of the survey participants were asked to indicate the practices that they considered a strength, with an explanation. On the reverse side the participants noted the practices that they considered a challenge to implement, also with a brief explanation. Surveys were collected before members of the research team facilitated a discussion about the practices, how they can be utilized, the challenges of employing them in mentoring and a more general question-and-answer session.

Salient Practices—Strengths

Based on discussions during the conference sessions and tabulation of the survey results, it became clear that a cluster of six of the salient practices were identified as strengths by the participants. These were all found to have 35 or more responses on the surveys ($n = 52$). Figure 5.1 shows the results.

[Figure 5.1 about here]

Figure 5.1. Salient practices that were considered a strength by conference participants ($n=52$).

The following responses from the mentor survey are discussed in rank order, beginning with those that the largest number of participants considered strengths.

<C>Salient Practice 6: Dedicate Time to One-on-One Mentoring.</C>

One-on-one mentoring is the practice most often viewed as a strength, and only nine participants considered it a challenge. One-on-one mentoring is the traditional model associated with UR (Kuh 2008; Lopatto 2003; Shellito et al. 2001). Several mentors commented on the benefits of a one-on-one approach:

“I find this [practice]easy to employ, as undergraduate research in visual art requires one-on-one mentoring [and] intense discussion about the student’s visual art (painting in my case).”

“Important for both personal connections and making sure nothing is going wrong on the project.”

“The structure of our program includes one-hour weekly meetings with students; I often spend more time with them, particularly in summer when we're in the field and lab together.”

The literature also shows that one-on-one mentoring is highly valued by both mentors and students (Cox and Androit 2009; Kuh 2008; Lopatto 2003; Shellito et al. 2001). Although there were very few open responses from participants in this study about the challenges associated with this practice, all were structural concerns (i.e., time and scale), rather than difficulty in developing one-to-one relationships. For those who do struggle with it, time is a major factor. Of the nine open-ended responses about the challenge of one-on-one mentoring, six participants reported that time constraints, especially in large research groups, are the primary issue. Faculty from large, research-intensive universities pointed out that one-on-one mentoring is impossible in laboratories of dozens of student researchers, making scale a significant issue for some institutions. The goal of UR “for all” therefore hinges on the development of resource-efficient models of mentoring that do not diminish the strong interpersonal connections between students and faculty mentors. Adopting a ladder approach involving more faculty, graduate students,

and near-peers could allow for increased capacity without compromising these highly valued personal relationships.

<C>Salient Practice 3: Teach the Technical Skills, Methods, and Techniques of Conducting Research In the Discipline.</>

Salient Practice 3—teaching the technical skills of research—received the second-highest number of responses as a strength for participants and the fewest responses as a challenge. Many mentors talked about the importance of skill development for students to understand the field, as well as to build confidence. The following responses relate to this practice as a strength:

“Essential to success—best way is to integrate into curriculum—we do this (research training courses).”

“I believe hands-on learning best facilitates skill development.”

“It gives them confidence to take risks, and me confidence that they will meet course objectives and produce quality work.”

“I love to be in the archives with students! Co-learning with them, that’s where the technical skills come from.”

Although few participants described the practice of teaching the technical skills of research as a challenge, it is apparent that matching the strengths and background of a student with what is expected in the project needs to be given careful consideration:

“Expectations of recall from prior classwork which then changes timeline. Also limited time and resources. [I] have difficulty explaining more difficult or time-

intensive methodology.”

“Research methods vary widely and I try to work with students' strengths, not to dictate that they follow my methods always.”

“The disciplinary scope of projects is often too wide and students are allowed to pick projects for which they do not have the background.”

As participants’ comments suggest, learning the methods and techniques of research in the discipline is crucial for students, no matter what the field of study. This could include instruction on ethical practices in the field, such as human subjects’ training, software skill development, or various approaches to archival searches. Mentors need to be intentional about this practice for student skill development as well as development of confidence and persistence. To aid in student skill development, especially in lab-based research, mentors often create research manuals for the techniques used in their research that they can share with students. Some academic departments that have built research into the curriculum have created units or modules on particular techniques that can be taught by a research supervisor, graduate students, or peer mentors, or that can be accessed online.

<C>Salient Practice 10: Encourage Students to Share Their Findings and Provide Guidance on How to Do So Effectively in Oral Presentations, Poster Presentations, and Writing.</>

The practice of guiding students in sharing their findings in writing and presentations was viewed by many as a strength in their mentoring practice. Below are examples of responses from participants:

“I build this in as an expectation from day 1. I want my students to coauthor an article with me by the end of semester.”

“I do this because it gives the students a challenge and oral presentation/writing skills are essential communication skills in our discipline.”

“So important! For students, when they disseminate [it] often really changes how they see themselves as authorities. And I’m primarily a writing teacher.”

“We have benefits of high institutional support of student conference travel. Take students at least to undergraduate history conferences, [and] as often as possible to my own professional conference. (All present at campus-wide research day.)”

However, mentors also reported having difficulties with this practice. Similar to the previous practices, the challenges involve time and resources:

“Hard to conduct quality research in appropriate timeline unless students come to me in 1st/2nd year; draft/revisions take time after graduation.”

“Some faculty don’t have funds to send undergraduates to conferences.”

“Students do not always value what they have done.”

Guiding students in sharing their work in writing and presentations appears to be a highly valued activity, and helping mentors identify ways and places to disseminate may help strengthen this practice. Some UR mentors noted that they had not been trained in guiding the writing and

revising process, so they felt ill-equipped to work extensively with students on written work.

Collaboration with campus writing centers or scientific-writing groups may be key to supporting UR mentors in this area of their work.

<C>Salient Practice 4: Balance Rigorous Expectations with Emotional Support and Appropriate Personal Interest in Students.</>

Many of the respondents affirmed that balancing rigor and emotional support is important for students' skill development and successful progression through the research process. The following are a few comments related to these strengths:

“Research is hard and daunting and things will go wrong. Students need support through these difficulties.”

“So much of my mentoring is dependent on open and honest discussion, so personal interest is an important component to the overall experience.”

“My role is to challenge them and support them so they can grow. I can't imagine working with someone without caring about their well-being.”

Most mentors expressed confidence about how to manage students' skill development. Many of the challenges in this area have arisen from mentors feeling less certain about how to support students emotionally, since that is not a common part of their research training. The following are some of the comments related to this practice as a challenge:

“Depending on students' needs, the emotional support could become a gray area. Clarity is needed about collaboration and the mentorship relationship from the start, but with some flexibility.”

“Faculty receive little guidance or training before getting ‘thrown into the ring’ and beginning to work with students.”

It does not appear that there is much disagreement about the needs of the student when it comes to emotional support, but some mentors were less comfortable with the affective aspect of the mentoring role. Providing emotional support for student researchers is an important area for faculty development at institutions committed to high-impact UR experiences, as the social-emotional component of UR mentoring has been widely recognized as critical to student success, particularly for students from underrepresented groups (for example, see Kendricks, Nedunuri, and Arment 2013; Mekolichick and Gibbs 2012; Showman et al.2013). As Thiry and Laursen (2011, 776) have reported, being “supportive, accessible, friendly, and [taking] an interest in [students]” is crucial for supporting undergraduate researchers. Mentors may want to intentionally make an effort to ask students about other aspects of their life besides their research, such as their experiences with other classes or their plans for holidays or weekends, to help create a supportive environment.

<C>Salient Practice 2: Set Clear and Well-Scaffolded Expectations for Undergraduate Researchers.</>

The practice of setting expectations and scaffolding the research process was viewed as a strength by many respondents. Examination of the open-ended responses revealed the importance of setting goals to help students through the process. A common response was that syllabi or learning contracts are very important for communicating clear expectations. The following are some representative responses for those who viewed setting clear and scaffolded expectations as a strength:

“I don’t usually know exactly what courses [they] have taken so I can’t make assumptions about what they know.”

“My scaffolding could be stronger but clarity and transparency of expectations is necessary for mentoring success.”

“Students need clear goals to chase.”

“The student and I create a course contract for independent study that lays out the individual project . . . doing so directs our time together as well as guides the students in their own art studios.”

Participants who indicated difficulty in implementing this practice see some disciplinary challenges with establishing clear expectations, as well as with the overwhelming demands that new faculty, especially, often experience:

“My discipline is so creative and open-ended that I struggle to set clear expectations for what is unpredictable.”

“The well-scaffolded part is difficult, just being fairly new to having research students.”

Experienced mentors suggested that implementation of a learning contract, syllabus, or similar set of requirements and deadlines are helpful for both the student and mentor to structure the research process. Such formalized agreements communicate clear expectations about the nature of the scholarly process from the outset.

<C>Salient Practice 7: Increase Student Ownership of the Research Over Time.</>

The practice of increasing student ownership over time was viewed as a strength for many of the participants. Ownership was viewed by mentors as important for their students in preparation for graduate school and identity development. Here are some comments from participants about the strength of this practice.

“Students have a stand-alone component of my research agenda. They write-up, present, etc. based on their personal research. [I] make it clear how their research is advancing my bigger project.”

“Students will perform better and develop a stronger sense of identity when they feel ownership of something.”

“It allows students to feel it is their research, not just another class project.”

“It helps me and better prepares the student for grad school, etc.”

The concern with this practice is that many did not feel they had enough time working with students to give them ownership or were uncertain about how to structure students’ increasing independence. Some challenges of helping students develop ownership are reflected in the following participant comments.

“For me, the problem is duration. I get mentees who are juniors or seniors. My time with them is limited to 1 year.”

“Not really sure how to do this.”

“With having students for only a short time, it is difficult to get them to this level.”

Helping students develop ownership of the research is an important practice for encouraging students’ independence, but mentors are in need of ideas for promoting student ownership of the research in which they are involved, especially when mentors are working with particular students for relatively short periods of time. Malachowski (1996) advocated for allowing the UR mentoring relationship to develop over an extended period of time. The relationship is described as one of several stages, culminating in the “transformation” and “separation” stages, making shorter-term pairings less suited to the development of students’ independence. Although longer-term research projects seem to be preferable for students to develop deep learning, a sense of increasing ownership is still possible in shorter research projects if carefully selected elements of the research can be allocated to students at the outset. Mentors can make explicit to students how their parts of the work, even seemingly small, contribute to the project’s larger goals. Ensuring that students are credited for their work in acknowledgments of publications and presentations may help students feel invested in the outcomes.

Salient Practices—The Challenges

We also asked workshop participants to identify which of the 10 salient practices presented challenges to achieving effective mentoring. We discuss the three salient practices that scored 20 or more responses indicating they posed a specific challenge for many participants (see Figure 5.2).

[Figure 5.2 about here]

Figure 5.2. Salient practices identified as a challenge by participants ($n=52$).

In group discussions after each conference presentation and in participant surveys, UR mentors voiced their struggles with implementing some of the 10 practices. The most commonly cited challenges were with planning for different students' needs and abilities (practice 1) and working with groups of student-researchers (practices 9 and 5).

<C>Salient Practice 1: Do Strategic Pre-Planning in Order to Be Ready to Respond to Students' Varying Needs and Abilities throughout the Research Process.<\>

Strategic pre-planning was the number 1 challenge for participants. Their common themes were limited time and differing skill levels of students:

“I could do more of this; time is also a challenge. Also to truly identify individual needs you need to know the students well.”

“I do very little of this—I find I am more responsive to issues that arise.”

“I struggle here! The pre-planning takes time that I usually give to more immediate issues. My goal is to do this for the fall.”

“I wish I could but I am early in my career; teaching/advising is a large demand of time.”

“My students come with such a wide variety of skill levels and interests that I need to prepare for this diversity.”

Based on these responses, it seems that pre-planning to respond to different students' needs and abilities must be an intentional process to ensure project success. Given heavy workloads for

faculty, it is no wonder that many describe “putting out fires” and responding in the moment to crises and other needs as they arrive. Nonetheless, investing time early in the process of research collaborations with students can actually save time in the long run. As scholars of UR have explained, mentoring students in research is, at its essence, developmental work; the focus of the enterprise is guiding students according to their varying degrees of experience and unique developmental needs (Brown, Daly, and Leong 2009; Malachowski 1996). Teaching students who are completely new to research lays the groundwork for breakthroughs in the future.

Important within this is an early diagnostic to understand students’ previous knowledge and understanding, which could form a useful part of the recruitment process. Alternatively, projects that spin out of class will have a known starting point and may involve groups of students with a shared level of interest and engagement. The following are a few responses from mentors who viewed planning as a strength:

“Both of these [pre-planning and being ready to respond to varying needs] need to be flexibly designed based on individual skills and state of the project. Also must build in flexibility about each of steps. There is frequent modifications or postponement or flipping of schedule.”

“I’m a planner and like to come to projects with clear (but flexible) expectations.”

“Students struggle initially to wade through a topic without specific guidance.”

In an effort to help with pre-planning, the mentor may want to consider basic principles of goal-setting to help motivate the student and mentor to be productive and effective (Latham and Locke 2007). When implementing goal-setting, SMART principles ensure that goals are specific,

measurable, achievable, realistic, and timely (Doran 1981; Weinberg and Gould 2015). Bowman and Stage (2002) found that personalizing research goals to individual students' long-term educational and career goals led to successful outcomes.

<C>Salient Practice 9: Create Intentional, Laddered Opportunities for Peers and “Near-Peers” to Learn Mentoring Skills and to Bring Larger Numbers of Undergraduates into Scholarly Opportunities.</>

Creating laddered research opportunities, in which more experienced students—whether senior undergraduates or graduate students—help mentor those newer to research, was seen as a challenge by most of the participants. Many of the concerns around this practice came from mentors stating they were not sure how to create laddered research groups or did not have enough time to teach mentoring skills to students. The challenges of utilizing this practice center on the time and expertise needed to teach mentoring skills to students:

“My limited time with undergrads makes this hard. With grad students I often have 3–4 years to develop these sorts of opportunities.”

“I am not great at creating these ladders, but I want to improve. I’m just not sure how.”

“When students are ‘natural’ mentors I facilitate that but I don't ‘teach’ mentoring per se.”

However, those who do create laddered research groups see them as effective means of professional development for senior undergraduates and/or graduate students:

“[I] have brought research students to my senior seminar to talk about writing.”

“Peer mentoring is powerful and efficient. Peer pressure is powerful motivation.”

“This also gives students a chance to establish an authoritative or scholarly identity. Former UR students often speak to my class.”

Once again, time constraints are the main concern. The bigger issue to address in trying to develop this practice, however, may be helping mentors teach mentoring skills to their students.

Laddered mentoring may fit best in lab settings, but it may also be developed in the curriculum and/or through working with other UR students in a department or school in an apprentice model. For example, longitudinal research projects that intentionally bring younger research students into the team so that they can learn techniques and skills from students who have been working on the research project for a longer time is a form of laddered mentoring. The cycle continues each year, as new students are brought in, and older students graduate. A mentor in classics has described recruiting students with different language skills to teach critical terms to their peers, so that their fellow students can help in decoding various European coin catalog entries as part of a successful UR project: building the Severan Database of ancient Roman coins (Langford 2014). Langford describes “slicing and dicing” various research tasks so that individual students can master certain skills and teach them to their peers. Allowing students to develop expertise in one small area of a larger research project allows for peer mentoring as members of the project share their distinct expertise.

This model also may go some way toward addressing the challenges posed by practices 1 and 5 (doing strategic pre-planning and building community among members of a research

team). Peer and near-peer mentors need more than proficiency in research to guide undergraduate researchers effectively; as the University of Wisconsin–Madison’s Entering Mentoring program has proposed, new mentors need training to evaluate students, address different learning styles, include diverse perspectives, and offer social-emotional support (Pfund et al. 2006).

<C>Salient Practice 5: Build Community among Groups of Undergraduate Researchers and Mentors, Including Graduate Students, Postdoctoral Fellows, and Other Members of the Research Team.</>

From the literature as well as the survey responses, it is apparent that cohesion among a team of researchers is important for the overall development of student researchers. However, the challenge of practice 5 is having sufficient time and an appropriate environment in which to promote a sense of community. The following are a few responses about such challenges:

“I just haven’t had time to reach out to others and support groups of students.”

“Lack of time in workload; lack of research environment/culture”

“Some students have a difficult time seeing each other’s strengths.”

“Some labs are too small or don’t have the funding to take on lots of students.”

Despite being a challenge, the practice of building community among groups of researchers was also found to be an important goal.

“It is important to foster a team spirit within the laboratory.”

“It is important to see that science and research is vulnerable and fluid. That multiple views gives more depth and richness to the process and product.”

“My discipline is collaborative by nature and I like to build teams of researchers. My department discusses the well-being of the student on a weekly basis; I have them over for dinner, out for ice cream. We take breaks to play wiffle ball.”

These responses indicate that a sense of community within a team of researchers is valuable for students and mentors. A community of researchers can be developed through opportunities to interact in both professional and social settings. A departmental journal club for UR scholars, which gives each team member the opportunity to present pertinent research literature to the whole group, can build both professional skills and community. Such academic activities are especially effective when balanced with social gatherings, including occasions as ordinary as groups of research students going to lunch together. Professional and social opportunities can be combined to great advantage, such as early-evening research seminars immediately followed by group meals where discussions can be continued. For institutions that have Student Affairs staff who are trained in team-building and have extensive interactions with students in co-curricular programs, such colleagues also could support this work through facilitating workshops and professional development activities for UR mentors and students.

The “Hidden” Practice</>

Participants rated one particular practice as neither a significant strength nor a challenge.

<C>Salient Practice 8: Support Students’ Professional Development through Networking and Explaining Norms of the Discipline</>

This is a practice that mentors may need help in leveraging. Common remarks about this practice referred to the importance of skill development for students, such as how to build a curriculum vitae, write professional e-mails, and network effectively with others in the field. The following comments are from those who view practice 8 as a strength:

“I seek out opportunities for students to present at a variety of conferences and to visit labs to connect them to the field and expand their opportunities.”

“Linking students to opportunities and faculty is an opportunity to share my network and help them link up to a supportive community.”

However, there are inherent challenges with trying to help students develop professionally, as indicated in the following comments:

“As faculty, we are not trained in professional development per se.”

“Helping lots of students network can be difficult due to time and money.”

“I may need to do more of my own networking to improve on this.”

To develop this practice, mentors may need to find ways to overcome some of the resource limitations and connect with other people on campus rather than externally for professional development. The people to whom students are connected and can contact for references and letters of recommendation, as well as those who might alert them to internship opportunities or relevant conference sessions, are important parts of their network for the future. To broaden that group, faculty could proactively introduce their mentees to other academics and researchers.

Many mentors in this study reported that their students disseminate their research outcomes. Preparations for conference presentations offer an ideal time to discuss some of the norms of the discipline related to conferences and peer review. Before travel to conferences, mentors have an opportunity to discuss appropriate attire for the conference events (presentations, banquets, “field trips”); the types of questions that students can expect to be

asked; and the ways to take advantage of the whole experience, including by making professional contacts. If the student plans to submit a paper for peer review, the mentor will need to discuss the process, the typical timeline, and the potential outcomes with the student. Mentors may even consider asking students to assist them with article reviews so the students can learn the process.

<A>The Salient Practices Revisited</>

Mentor responses to the 10 salient practices from the literature, particularly in terms of the challenges posed for implementation, have caused refinement of the wording of the 10 practices. Table 5.1 summarizes the 10 practices as reworded to be more inclusive and proactive. For example, the revised list obviates the need for an institutional context that includes graduate students and/or postdoctoral fellows, who were previously mentioned in practice 5. It is hoped that faculty can use the 10 practices as a checklist to reflect on their mentoring habits and methods.

[Table 5.1 about here]

Implications for Mentor Development</>

Mentor reactions to the 10 salient practices in terms of what they perceive to be their current strengths and challenges revealed a suite of implications. Mentor training and development is clearly needed in particular areas. Most notably, pre-planning, scaffolding, and emotional support are all areas where mentors said they felt underprepared. Although goal-setting was viewed as unproblematic, scaffolding the students' learning was viewed as a challenge. Such a response was not purely due to time limitations but was also linked to faculty expectations of students coming into research for the first time, the time required for students to grasp a new research area and body of knowledge, and the demands of learning sophisticated

techniques and methods. It was heartening to learn that faculty participants enjoy the teaching in those areas, but appreciating the time needed for such learning may help mentors plan for future projects more realistically. Therefore, recommendations for individual mentors include gaining an understanding of students' previous knowledge and skills during the recruitment process and building this personalized knowledge into goal-setting as part of a structured research process with clear formalized expectations; intentionally building research skills in the curriculum early in the student experience, prior to more resource intensive one-to-one mentoring; and proactively finding out more about the student's university/college experience outside the research project to provide social and emotional support.

Scaffolding research skills so that students develop a sense of ownership in the research over time was also troublesome for mentors who aimed to achieve publishable outputs within a tight timeframe. With careful planning, it is possible for research projects to emerge from the curriculum so that student researchers have familiarity with material that has been recently covered. Community-building was seen as particularly challenging in contexts where one-to-one mentoring dominated, but opportunities to build a research team go far beyond the traditional lab group; peers and faculty in other departments, for example, may collaborate on some aspects of the research, such as reviews of the literature or basic protocols for labs, studios, or archives. One area that faculty seem to be under-utilizing is sharing the mentoring process in ladderred groups so that students learn mentoring skills along with research proficiency. Occasionally making students aware of the intentionality of aspects of the mentoring process would be a step forward, but there is great potential to explore co-mentoring as well as peer and near-peer mentoring, and at the same time build community.

The “hidden” nature of practice 8 (supporting students’ professional development), seen neither as a particular strength nor challenge by most participants, came as a surprise. However, networking and learning the norms of the discipline are essential for undergraduate researchers—not only for those hoping to pursue a career in research or academia. Professional development teaches students how to distinguish themselves, market their skills and work ethic, and apply their undergraduate learning to workplace demands. Brokered networking is important not just for building students’ lists of contacts, but, more important, for their professional identity, as they expand their knowledge of various occupations and possible career paths in their chosen field. Knowing people in their field and understanding expectations and values can make the key difference for future job-seekers, especially in an increasingly competitive environment for skilled employment. Yet not all faculty have extensive networks, and faculty are not necessarily best placed to advise students about careers outside higher education. One professional development implication could be to establish networks of colleagues involved in mentoring so that they can co-mentor each other, and share and enhance their academic networks in this area. Indeed, the more people who can be brought into the higher education institution for networking and capacity-building, the more students can benefit, especially when underrepresented groups can be introduced to appropriate role models.

Mentoring effectiveness can be enhanced through using the list of 10 salient practices as a self-reflective tool for the professional development of faculty. Table 5.2 provides a series of prompts for reflection on each of the practices for that purpose.

[Table 5.2 about here]

However, rather than treating each practice as one in a series of options, the overarching recommendation following this research is to consider the practices as a holistic pedagogy. For

every practice considered to be a challenge by some faculty, other mentors viewed it as a strength. Sharing practice among mentors is important to develop new faculty, communicate about resources and expertise, develop training within institutions, and to network—all benefits to work in supporting students, especially as these students are the ones most likely to become future faculty.

This chapter has focused on the practices and their implications for individual mentors; however, the pedagogy proposed could be enhanced by adopting a more institution-wide approach. A sense of community within a team of researchers is valuable for both students and mentors. Adopting a ladder approach involving more faculty, graduate students, and near-peers could allow for increased capacity, opening up the benefits of UR to more students. Faculty and their mentees can connect with other people on campus for professional development and networking to build not only a research culture but also a professional working milieu. Using large projects to involve more students over a longer period of time can provide a self-sustaining environment. Institutional investment in mentor-training—particularly in the area of planning for individuals with different learning styles, diverse perspectives, and needs involving additional social-emotional support—is also recommended. Identifying fora to disseminate student research can be enhanced by collaborating with others on campus, and institutional showcasing events and activities can be created.

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Table 1. Ten salient practices of undergraduate research mentoring.

1	Strategic pre-planning to respond to students' varying needs and abilities throughout the research process.
2	Set clear, scaffolded expectations.
3	Teach the technical skills, methods, and techniques of conducting research in the discipline.
4	Balance rigorous expectations with emotional support and appropriate personal interest in students.
5	Build a sense of community among members of the research team.
6	Dedicate time to one-on-one, hands-on mentoring.
7	Increase student ownership of the research over time.
8	Support students' professional development through networking and explaining norms of the discipline.
9	Create intentional, laddered opportunities for peers and "near peers" to learn mentoring skills and to bring larger numbers of undergraduates into scholarly opportunities.
10	Encourage and guide students to share findings in presentations and writing.

Table 2: A list of question prompts for guiding self-reflection on engagement with each practice by faculty UG research mentors

1. How do you address variability in students' preparation, motivation, and skills?
2. Do you create syllabi or learning contracts with scaffolded skills and interim deadlines?
3. How do you orient students to the critical skills, methods, and expectations of your discipline?
4. How do you manage varying relational expectations from different types of students?
5. What types of social/interpersonal team development do you provide for students?
6. How do you manage students' needs for one-on-one time with you?
7. What are some ways you help students gain ownership of their projects?
8. How do you support the professional development of your research students?
9. How can faculty/staff help ensure that peers and near-peers mentor other students effectively?
10. What do you find most challenging about supporting students' dissemination of research?

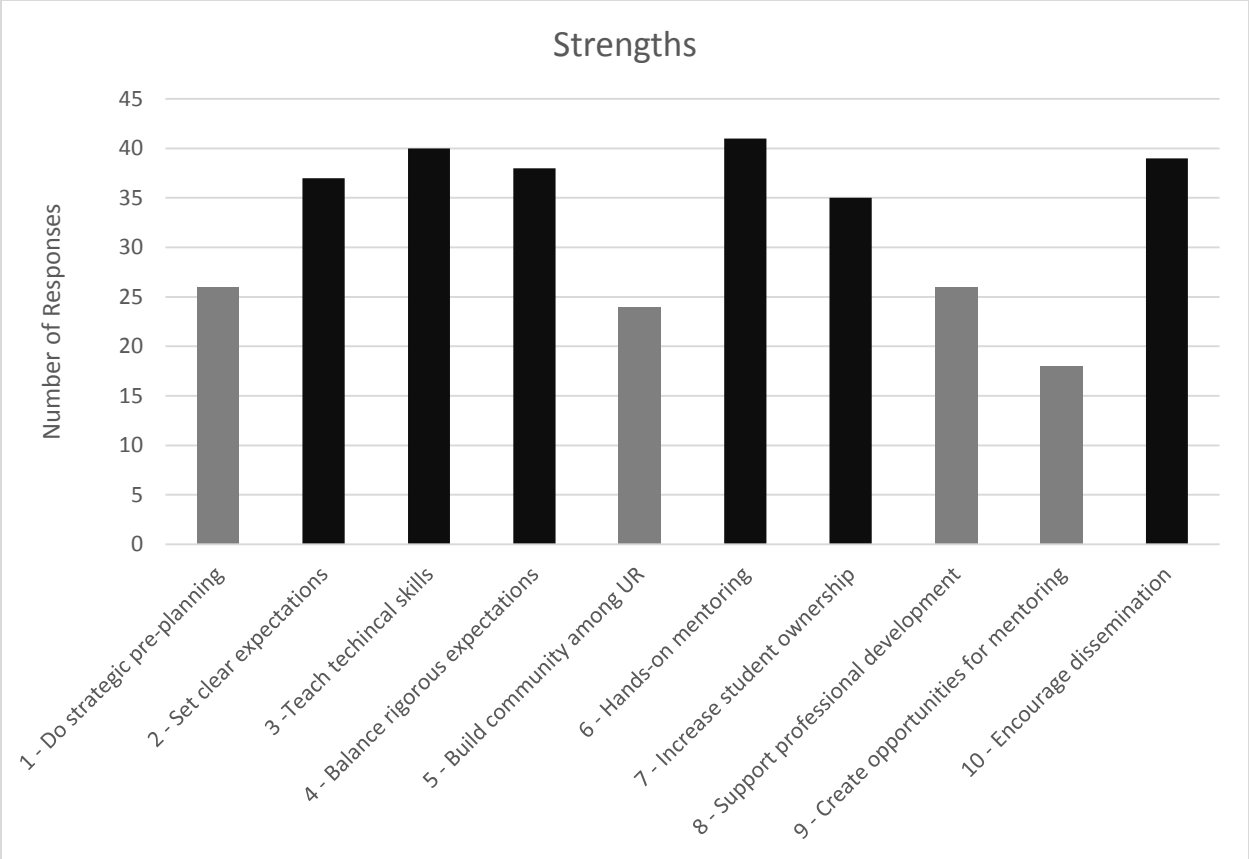


Figure 1. Salient practices that were considered a strength by conference participants (n=52).

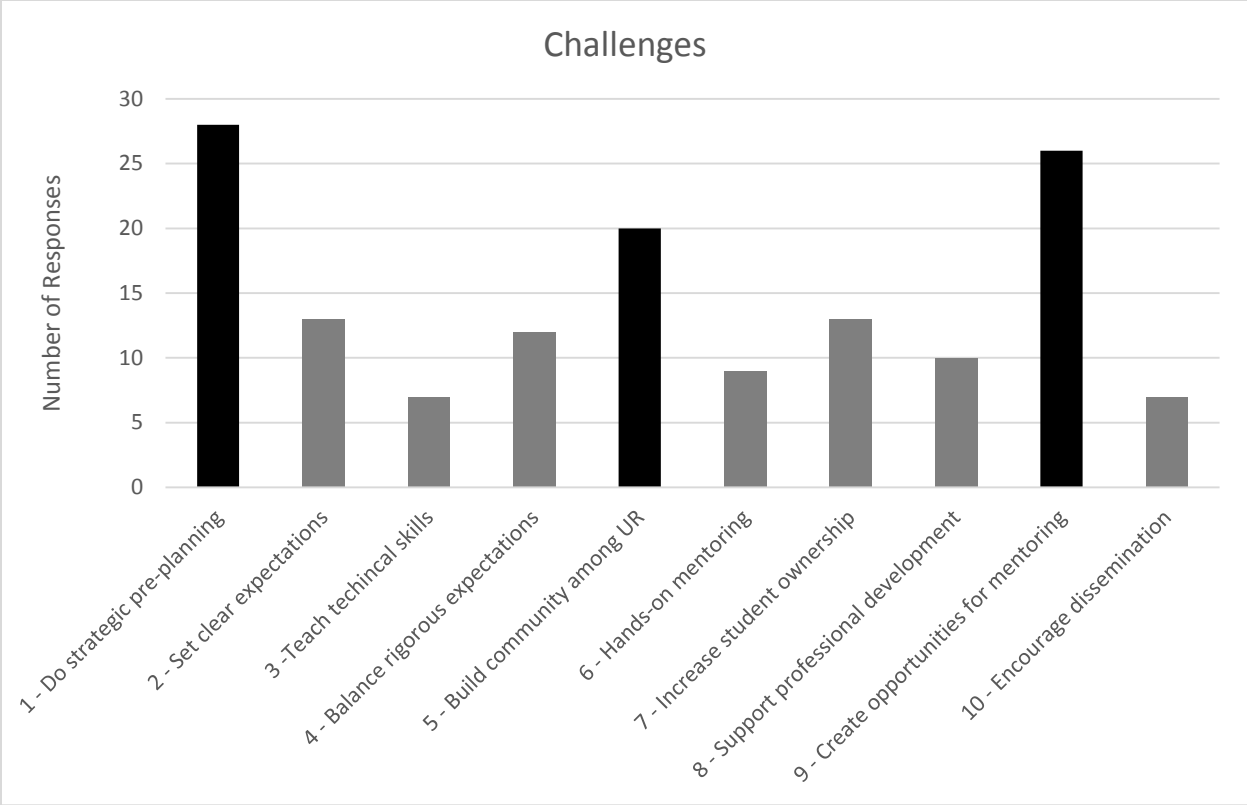


Figure 2 – Salient practices identified as a challenge by participants (n=52).