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Sarah K. Young

University of New Hampshire, Durham

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**Preliminary Findings for STEM Undergraduate Research Mentoring Across
Neurodiversity**

Sarah K. Young

University of New Hampshire

Undergraduate Honors Thesis

Dr. Jeffrey Halpern

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The importance of mentored undergraduate research is well documented (Davis 2017). Engaging in undergraduate research is associated with better outcomes for students who go on to graduate school (Gilmore 2015). This ongoing research aims to bridge the gap between student perceptions and mentor practices, focusing on applying a thriving model to undergraduate students. The thriving model was used to move away from thinking about surviving college, to thriving in this environment (Gesun 2021). For this research, thriving was defined as “a multidimensional process by which undergraduate students develop factors that allow them to function optimally in research experiences.” This definition was provided to researchers and mentors to frame their thinking. Poor mentorship affects many researchers across fields and institutions, but it is especially problematic for underrepresented people who may feel the need to downplay their issues and not disturb the status quo. For this reason, this research focused on the experiences of neurodivergent researchers. Neurodivergent is defined here as people who experience and interpret the world differently than “typical” due to a variety of mental disabilities. People with disabilities, including neurodivergent people, are currently underrepresented in STEM research (Powell 2021). It is important to understand the experiences of these individuals to better support those in the field. In order to investigate firsthand accounts of the experiences of STEM undergraduate researchers across neurodiversity, interviews were used to find trends in experiences. Eleven interviews with researchers and mentors were conducted to investigate the effects that mentoring practices have on thriving among undergraduate STEM researchers. Neurodivergent researchers were additionally asked how their disabilities affected their ability to conduct research. This research aims to provide mentors with every tool available so they can best support their students across neurodiversity.

Common trends among undergraduate researchers were analyzed focusing on a few factors. The qualities of an optimal mentor relationship were of primary importance. Factors like communication, autonomy, work-life balance, openness, adaptability, and respect were observed often among the researchers that were interviewed. Additionally, it was important to look into what thriving meant to each individual student. Although the definition was the same, each participant understood thriving slightly differently in the context of their undergraduate research experience. Finally, trends among the issues and successes experienced by neurodivergent researchers were analyzed to look for trends among them. Mentors also provided interesting perspectives on how they consciously mentor students and the training they have received on

this. This research aims to understand if mentoring practices can be adjusted to best fit the needs of students across neurodiversity.

All undergraduate students interviewed pointed to open communication when discussing their “optimal mentor relationship.” One participant described open communication as “being upfront with your expectations.” They discussed how important communication was for problem solving, especially during group meetings, to work together when there are challenges with a project. They went on to say, “open communication is a great way to make sure that you're staying on track [which] will help you thrive.” Another participant described their optimal mentor relationship as having three aspects, “open communication, no judgment, and respect.” They specifically discussed communication with regards to mistakes made in the lab. They explained that being able to tell their lab mentor when they made a mistake was beneficial for their thriving because “[they] take those mistakes and [they] turn them into something like a learning moment.” Knowing that their lab mentor would not respond harshly to their mistake allowed them to turn it into a tool for their growth. Additionally, one participant discussed how important comfortable communication is with a lab mentor. They appreciated that their mentor was easy to talk to, as that allowed them to ask more questions, especially saying, “if you're not comfortable talking to [your mentor], you won't like learn really.” Asking questions was beneficial to them to advance their knowledge and gain more from their research experience. Open communication is necessary so that all lab members can be working together towards their highest potential.

Autonomy and flexibility also came up several times when participants were discussing aspects of their lab they appreciated or ways they believed their mentors could improve. One participant provided “more autonomy in the research” as something they believed would promote more thriving in their research. They discuss wanting to formulate their own research questions and being able to build off of the existing projects in the lab, instead of simply following a procedure given to them. They identified “personal growth and understanding” as the effect of this increased autonomy. They posit that their mentor could improve by asking undergraduate students more about their interests, so they can be best matched with the type of research that they are interested in. Another participant discussed autonomy and independence in scheduling and pacing of their lab work. They defined thriving as “feeling comfortable that I'm

learning at a pace that works for me.” Their ideas for an “optimal mentor relationship” related to this as well, as they mentioned “giving [them] the flexibility to have a schedule that works for [them]” as a key quality. Being able to adapt to people’s preferences is extremely important when mentoring a team of researchers that all thrive differently. Some researchers will need a lot of autonomy to work efficiently; others, especially those just starting out, will require a more guided approach. One participant discussed how having a graduate student mentor allowed them to have more support and structure during their research. This later led to more independence as they became comfortable in the lab. Autonomy is extremely important as researchers learn and grow in a lab, but support must come first.

The importance of allowing undergraduates to have a work-life balance, or typically a work-life-school balance, was brought up several times during interviews. One participant said that they would like a mentor who is “cognizant of work-life balance.” They believe that mentors should be aware of the workload that is placed on undergraduate researchers and ensure that lab tasks are not interfering with their mental health. “time management issues” were brought up as an aspect of student’s lives that can affect thriving a great deal. They went on to communicate that sometimes mentors need to be flexible with their deadline to ensure researchers are not overstressed as a result of their research. This participant felt that mentors being aware of “the balance between free time, lab time, school time” was important to promote thriving in undergraduate researchers. Similarly, another participant said “the balance between working in a lab and extracurriculars and school” affects thriving. Balance is extremely important in undergraduate research as it should always come secondary to the coursework that student is completing. One participant specially noted that their research mentor would highlight that school came first, and this allowed them to be more comfortable with their mentor when they were not able to complete a task. This comfortability ultimately facilitated openness in their mentor relationship and allowed them to further thrive during their research experience.

Participants often highlighted the importance of questions, especially when they were just beginning their undergraduate research. Participants discussed how the ability to ask questions and for assistance allowed them to perform better. One participant said, “I was able to do things I was confident in, but then also like have the help there when I needed it.” This allowed them to thrive in their lab and feel more in charge of their research, while still being supported by their

mentor. Questions are extremely important for undergraduates conducting research to fully understand what they are doing. Several researchers talked about how they had questions about the lab or research that they did not feel comfortable asking their mentor or others in their lab. Even students who said their lab mentors were supportive and nonjudgmental said they didn't want to bother other lab members with "silly questions." However, those that did ask questions said this improved their experience, with one participant saying, "I think the biggest effect that helped me thrive in her lab was just answering questions aspect and the helping me understand what I'm actually doing so I feel like I'm actually involved in the research and that this is a big motivator." When undergraduates are asking questions, it means that they are engaged in their research, and this should be rewarded. For many students, their mentor's openness was one of the things they appreciated most in their relationship because it allowed them to be comfortable and confident in their research experience.

In discussions with neurodivergent participants, most of them communicated that being neurodivergent has exacerbated many stressors that are already present in research. One such individual discussed how being autistic affects their ability to follow lab procedures. Specifically, they talked about how their lab has very detailed Standard Operating Procedures (SOPs) for experiments, but those are not always present. These procedures are so important for this individual to feel comfortable conducting an experiment. They said, "there are details to me that feel important that I've noticed don't feel important to others," and SOPs are one way to make sure all of the relevant information is communicated to the researchers in your lab. This participant highlighted how having SOPs provided them with comfortability which "allowed [them] to develop confidence but also develop creativity." Another individual discussed how issues with their research project were made worse due to their anxiety. They said, "especially when you're doing research because you get very anxious that you're not on pace or this isn't working out." Lab research is often stressful for everyone who is involved with it, but some people may feel this effect more. They went on to talk about how labs are often very messy and loud places and having OCD (obsessive compulsive disorder) made working productively in a lab difficult. Their lab mentor was able to provide accommodation and set aside times and spaces when they were able to work in the lab with less people around. They explained how "that kind of distraction free [environment] is definitely how [they] thrive." These accommodations are

extremely important if mentors wish to cultivate a more diverse lab group where all members are supported in their growth.

Researchers were asked what it would mean for them to thrive within their undergraduate research experience and a variety of answers were provided. Most of the answers given were intangible, so mentors would not be able to fully gauge this without asking the students. One participant said thriving would mean they “feel accomplished, for [them] to feel like [they] learned something from the experience.” If the goal of a research mentor is to do what they can to make sure every member of their lab is thriving, then they may not be able to figure out if they are succeeding on their own. Another participant said thriving is “feeling comfortable that [they’re] learning at a pace that works for [them].” This pace and the comfortability that comes along with it will differ greatly depending on the person. Mentors that wish to promote thriving need to ask students what that means for them and make changes to their mentoring practices based on those answers. Finally, one participant said, “thriving would be in a point where I feel comfortable enough to ask questions, but competent enough to explore my research and what needs to be done and what I want to do with my research.” This harkens back to several factors discussed earlier: communication, ability to ask questions, and autonomy. Thriving is not a one size fits all model, but rather a framework to understand how researchers perceive their experiences. Reading all of the literature that exists about mentorship is no match for simply talking to mentees about their experiences and goals within their research.

The mentors that were interviewed gave similar answers to the researchers when asked what it means for an undergraduate researcher to thrive in their lab. One participant specifically pointed out that it is success as defined by the student and “student to student dependent.” Mentors largely discussed the same aspects of mentorship as students; the importance of clear communication, how autonomy is built in their lab, and the overall power structure. Mentors were also asked what kind of training they have received for the mentorship. All of the mentors had received little to no training, and most were disappointed in this. Only one of the four mentors interviewed had received any mentorship training through UNH; another had gone to a mentorship workshop at a conference. Two of the participants even pointed out how this lack of training extends beyond mentorship, with one of them saying, “This is a strange job in that--

being a professor--that you were really never trained for.” All of the mentors discussed how they have used their experiences as a mentee to shape their mentorship style now.

An overarching trend among both the researcher and the mentors was difficulty defining mentoring styles. Researchers generally had trouble characterizing their mentor’s mentoring style. Similarly, most mentors discussed the tangible actions they make, not the overall style they use. This may indicate a lack of literacy among people in academia of the types of mentoring that exists and the style of mentoring that can be used. When mentoring is boiled down to meetings, lab supervision, and professional development, all of the intangible aspects get lost; however, students notice those intangible aspects. Multiple researchers discussed the hierarchical, or lack thereof, structure in their lab. They notice when mentors are providing more autonomy and harsher criticism to those that have been in the lab longer. Mentors may not discuss with their students the path they see for them within their lab, but students see it happening in real time. Clear communication is necessary for researchers to understand that mentors are making conscious choices with their mentorship.

The most effective tool for strong mentorship is communication. This communication must be clear, respectful, and provided in a way that works for each student. Some students may need communication to occur in two modes, written and verbal. Additionally, mentors must be able to adapt their style and practices to different students and adjust their mentees’ independence as they gain competence and confidence. Highlighting the importance of work-life balance in the lab will ensure that students feel comfortable coming to their mentors when they need flexibility. This balance is something that needs to be both stated and modeled to be communicated effectively, with students seeing their mentors making life, as well as work, a priority. Mentors need to be patient with their undergraduate students, especially when they are new to research. These students will have a lot of questions and it is important to foster a culture that encourages student researchers to ask these questions. Finally, mentors should acknowledge and understand that people’s brains work differently, and that they may even have a neurodivergent researcher in their lab and not know it. Most of the neurodivergent participants who were interviewed did not tell their mentor they were neurodivergent. This is why it is important to be adaptable to all students, whether or not they have submitted for formal

accommodation or not. Overall, mentors should show respect for all their mentees, both in their communication and in their actions.

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