Rethinking Research Mentoring: A Tutorial on How and Why to Implement a PhD Student-

Mediated Mentorship Model

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Abstract

Purpose: In this tutorial, we describe the initiation and implementation of a recently developed

PhD Student-Mediated Mentorship Model (PS-MMM) used within our lab. In a PS-MMM, PhD

students mentor graduate and undergraduate students under the direction of a faculty advisor.

The model aims to address the PhD shortage by (a) teaching PhD students to be research

mentors to facilitate their success in the early career years and (b) encouraging clinical graduate

students to transition into and be successful in research doctoral training. As a third objective,

we aim to address the research-practice gap by increasing the research experiences available

to undergraduate and clinical graduate students through implementation of a PS-MMM. We

provide a step-by-step outline and case examples for initiating and scaling up a PS-MMM.

Conclusions: Implementation of a PS-MMM has led to consistent, positive benefits for mentees

and mentors within our lab. The observed benefits, feasibility, and flexibility of our PS-MMM

support more widespread use of PS-MMMs within other Communication Sciences and

Disorders programs.

Rethinking Research Mentoring: A Tutorial on How and Why to Implement a PhD

Student-Mediated Mentorship Model

The discipline of Communication Sciences and Disorders (CSD) faces a chronic

shortage of PhD-prepared persons to hire into faculty positions (American Speech-Language-

Hearing Association [ASHA] Academic Affairs Board, 2019). For at least two decades there has

been a critical need for well-prepared CSD PhD graduates who can pursue academic and

research careers. In 2002, the Joint Ad Hoc Committee on the Shortage of PhD Students and

Faculty in Communication Sciences and Disorders sounded the alarm for faculty positions in the

discipline going unfilled. At that time, 6-7% of doctoral faculty positions were unfilled and the

number was expected to "climb significantly" across the decade (Council of Academic Programs

in Communication Sciences and Disorders [CAPCSD], 2002, p. 2). Despite improvement since

2002 in some areas of concern (e.g., more doctorates granted annually and increased

percentage of CSD PhD graduates who accepted a faculty-research position in CSD in the

United States), the need to ensure "a sufficient PhD student and faculty-research pipeline and

workforce is imperative to the sustainability of all aspects of the CSD discipline – including

teaching, research, and clinical practice" (ASHA Academic Affairs Board, 2019, p. 2). Several

key statistics indicate the CSD discipline is far from eliminating the PhD shortage. Of the full-

time faculty positions filled, only 63% of individuals had earned a research doctorate (ASHA

Academic Affairs Board, 2019). Further, research doctorate programs only filled 45% of their

first-year student openings in 2017-2018 (CAPCSD & ASHA, 2020). Although programs are

trying to attract more faculty members with research doctorates and more PhD students, many

such calls are being left unanswered.

The most obvious need is for faculty who can prepare clinicians in speech-language

pathology and audiology. However, the less obvious but no less important need is for faculty to

conduct research that advances the knowledge base of the discipline. Successful mentored

research experiences provide one avenue for encouraging capable CSD undergraduates and

clinical graduate students[1] to seek research training (i.e., PhD; CAPCSD, 2002; Davidson et al., 2013; Osmelak, 2019). Following successful mentored research experiences, students are in stronger positions to seek and complete research doctorate programs.

The CSD discipline, like many other disciplines (Brownson et al., 2012; Douglas et al., 2015; Green et al., 2009; Grol & Wensing, 2013), also faces a persistent challenge in effectively transferring research knowledge from research settings to clinical practice (Greenwall & Walsh, 2021; Olswang & Prelock, 2015). The wide research-practice gap places individuals and their families who seek and receive services from speech-language pathologists (SLPs) and audiologists at risk for receiving suboptimal or even detrimental services. SLPs report multiple barriers to closing the research-practice gap and engaging in evidence-based practice including limited time, caseload size, lack of access to journal articles, and lack of comfort interpreting statistical analyses in research articles (Greenwall & Walsh, 2021; Metcalfe et al., 2001; O'Connor & Pettigrew, 2009; Thome et al., 2020; Zipoli & Kennedy, 2005). Training in evidence-based practices during graduate training and clinical fellowships has been positively associated with higher use of evidence-based practices (Greenwall & Walsh, 2021; Zipoli & Kennedy, 2005). Mentored research experiences offer meaningful opportunities to learn many skills important for engaging in evidence-based practice including, but not limited to, how to locate and understand research articles, framing research or clinical questions, gathering and analyzing evidence, and interpreting and discussing results.

Given these needs, the benefits of mentored research experiences are critical to the future of the CSD discipline. We offer a recently developed PhD Student-Mediated Mentorship Model (PS-MMM) implemented within our lab (at Vanderbilt University Medical Center) as a tool intended to reduce this chronic PhD shortage and narrow the research-practice gap. This model diverges from traditional mentoring models, which are prevalent in CSD and characterized by

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[1] In the context of this article, we use the term "clinical graduate students" to refer to master's in speech-language pathology students and doctorate of audiology students.

hierarchical, one-to-one relationships in which a more senior individual (e.g., professor) shares expertise with a more junior individual (e.g., student; Bland et al., 2009). A PS-MMM instead draws from cascading, near-peer, and group mentoring models used in related fields (e.g., laboratory-based sciences and medical education). A PS-MMM simultaneously addresses three key objectives. First, PhD students learn to be research mentors to facilitate their success in the early career years. Second, implementing this model encourages clinical graduate students to transition into research doctoral training and increases the likelihood of that transition being successful. Third, engagement in positive mentored research experiences equips clinical graduate students to be more effective consumers of published research and to more readily adapt their clinical practices to current evidence. This tutorial is designed to describe a PS-MMM and consider its potential benefits for PhD students, faculty advisors/lab directors, student research mentees, and the CSD discipline especially in regard to reducing the chronic PhD shortage and narrowing the research-practice gap.

Overview of PS-MMMs

In a PS-MMM, PhD students mentor clinical graduate and undergraduate students under the direction of a faculty advisor. In our early development of this model, a PhD student mentoring an undergraduate or master's student on a thesis project under the direction of a faculty advisor was the most common arrangement. Within this arrangement, three primary relationships are formed between the (a) mentee and PhD student mentor, (b) PhD student mentor and faculty advisor, and (c) mentee and faculty advisor. The relationship between the mentee and PhD student mentor is a near-peer mentoring relationship. The faculty advisor and PhD student mentor share responsibility for providing support and guidance tailored to the mentee's needs.

In labs with a faculty advisor mentoring multiple PhD students who are mentoring undergraduate and/or clinical graduate students, intertwined relationships create a supportive network. The relationships do not occur in isolation. Thus, the model incorporates aspects of a

group mentoring model. Additionally, relationships between PhD student mentors and between mentees emerge. These relationships are near-peer relationships between individuals who are at similar training stages. Mentees and PhD students also have the opportunity to observe relationships between other lab members (e.g., PhD student mentor-mentee relationships and faculty advisor-PhD student relationships) that may influence how they enhance their own relationships. For example, they may apply strategies they observe other pairs using to communicate effectively, share ideas, or complete tasks efficiently.

A PS-MMM diverges from the traditional mentoring model and aligns closest with a cascading mentorship model with aspects of near-peer and group models. Cascading mentorship models commonly are used in laboratory-based sciences and medical education (Feldon et al., 2019; Golde et al., 2006). More senior students teach more junior students (Golde et al., 2006). This pattern results in mentorship and knowledge that flows downward from the principal investigator indirectly to junior students through the direct relationships between senior and junior students. To a more limited degree, this type of model has been used in the discipline of CSD, often under another name, such as a "hierarchy model" (Carsrud, 1984; Speight Atkins et al., 2021). As in a "cascading model," more experienced students take some responsibility for training and supporting the less experienced students in a hierarchy model (Speight Atkins et al., 2021). In a PS-MMM, this mentoring flow occurs, but often with more direct interaction between the faculty advisor or principal investigator and junior students than would occur in a lab that is strictly implementing a cascading model. Results of a recent investigation of a cascading mentoring model highlights the benefits of more senior students engaging in the educational experiences of less senior students. The study included 336 PhD students in laboratory-based sciences across 53 universities. Junior PhD students were more than four times as likely to show positive skill development trajectories when postdoctoral students and senior PhD students participated in lab activities than when they did not (Feldon et al., 2019).

In a near-peer mentoring relationship, the mentee and mentor are close in developmental level. Exactly how close varies. Examples include undergraduate and post-baccalaureate students mentoring high school students engaging in science, technology, engineering, and math research (e.g., Anderson et al., 2019; Edgcomb et al., 2010; Tenenbaum et al., 2014), senior nursing students mentoring beginning nursing students (Giordana & Wedin, 2010), and medical students mentoring other medical students with similar levels of training (e.g., Bulte et al., 2007; Tan et al., 2017). In our implementation of a PS-MMM, mentor-mentee relationships have ranged from PhD students mentoring high school students to PhD students at the same stage mentoring one another.

The group mentoring model (Columbia University Provost's Advisory Council for the Enhancement of Faculty Diversity, 2016) focuses on mentoring relationships among multiple individuals rather than a single pair. This group mentoring effect is most evident when a PS-MMM is implemented in a lab with multiple PhD students and mentees. The faculty advisor can share mentoring advice with the PhD student cohort as a group. This method can be more efficient for the faculty advisor than individual meetings and enables PhD students to work collaboratively to apply the knowledge shared by the faculty advisor.

Potential Benefits of a PS-MMM

Encouraging Undergraduate and Clinical Graduate Students to Pursue Research Doctoral Training

Mentored research experiences and broader mentoring opportunities have yielded benefits across varied academic programs and educational levels. Undergraduate students have reported overwhelmingly positive evaluations of their research experiences and exhibited far-reaching benefits (Dolan & Johnson, 2009). Students who engage in research experiences showed increased research competencies, analytic skills, leadership skills, and confidence (Bauer & Bennett, 2003; Laursen et al., 2010; Seymour et al., 2004). They also reported increased interest in research, pursuit of higher education (including attending more research-

intensive institutions), and development of a professional identity (Bauer & Bennett, 2003;

Hunter et al., 2007; Kremer & Bringle, 1990; Russell et al., 2007; Seymour et al., 2004). For the

discipline of CSD, positive mentored research experiences can lead undergraduate and clinical

graduate students to the pursuit of research doctorates and curtail the PhD shortage.

Enhancing the Quality of Mentored Research Experiences

For mentored student research to occur, mentors must fulfill mentoring responsibilities.

McGee (2016) contended that, "[r]egardless of the philosophy or specific definition of mentoring

that one adopts, most agree that mentorship ideally consists of a reciprocal, dynamic

relationship between mentor (or mentoring team) and mentee that promotes the satisfaction

and/or development of both" (p. S232). Within an academic context, this relationship spans

multiple domains including research, interpersonal skills, psychosocial and career, cultural

responsivity and diversity, and sponsorship (Pfund et al., 2016). Outstanding mentors exhibit

admirable personal qualities (e.g., enthusiasm and compassion), act as a career guide, support

a balance of professional and personal responsibilities, and are a role model for other mentors

(Cho et al., 2011). ASHA outlines many traits of successful mentors, including being flexible,

having knowledge, giving constructive feedback, and networking and finding resources (ASHA,

n.d.-a). The depth and breadth of these traits reveal the intensive nature of a mentoring

relationship. The reality is that no one individual possesses all desired traits to the optimal

degree. Rather, the mentee gains access to these traits from engaging in mentoring with

multiple people (ASHA, n.d.-a). Thus, PhD students and faculty members can play

complementary mentoring roles.

Under a PS-MMM, mentees have access to multiple individuals as mentors. How the

faculty advisor and PhD student mentor engage with the mentee enhances the quality of the

experience. The faculty advisor's direct interactions with the mentee are expected to be at a

higher level (e.g., critical thinking and career development) and focus on the "big picture," rather

than day-to-day research tasks. In the traditional mentorship model, these higher-level skills can

be overlooked due to time constraints. In addition, under a PS-MMM the student gains unique

insights and support from the PhD student, who is absent in the traditional model. The PhD

student mentor shares knowledge and skills across a relatively small developmental gap and

manages day-to-day research tasks and questions. Mentees may be more willing to express

confusion to another student than to a faculty advisor (Currens & Bithell, 2003; Giordana &

Wedin, 2010). Further, PhD students may better understand mentees' knowledge gaps than

mentors at a much higher developmental level (e.g., faculty advisor, Giordana & Wedin, 2010).

Drawing from their knowledge and experience and guidance from the faculty advisor, PhD

student mentors can assist students in transitioning from consuming knowledge to contributing

to the creation and dissemination of new knowledge.

Increasing Capacity for Faculty Advisors to Increase the Number of Mentored Research
Opportunities

Identifying enough faculty members who are willing and able to provide research

mentoring is a challenge, particularly in light of the many demands on faculty members' time

and attention (Boyer, 1998; Desai et al., 2008). A mentoring relationship is intensive and

requires substantial time to support the mentee's development (ASHA, n.d.-a; Cho et al., 2011).

The time required under the traditional one-to-one mentoring model may be prohibitive for

faculty advisors to mentor more than one or a few students at any given time. Consequently, the

number of mentored research opportunities remains small.

Under a PS-MMM, the PhD student fills some aspects of the intensive mentoring role.

The faculty member thereby is freed to engage at a higher level and/or to mentor more students

at any given time. A PS-MMM enables faculty members to use their time and energy efficiently

to oversee the PhD student mentor-mentee relationship. Due to the shared responsibilities,

faculty members may be more attracted to this type of mentoring and agree to mentor more

students. Subsequently, more faculty members may experience the positive impacts of

mentoring students, such as increased personal satisfaction and career rejuvenation (Bland et al., 2009).

Increasing Diversity of CSD PhD Students and Faculty Members

Research mentoring is critical to attracting individuals to PhD training and, ultimately, to academic and research careers. The need for research mentoring is all the more critical in CSD given the unabated shortage of PhD-prepared persons to hire into CSD faculty positions (ASHA Academic Affairs Board, 2019). Of substantial concern is that access to mentoring in academia has been lower for underrepresented racial and ethnic minority students than for non-minority students. Unfortunately, the same is true for faculty members, which likely impacts faculty advancement and retention (Beech et al., 2013; Gonzalez, 2006). This lack of mentoring for persons from underrepresented groups has substantial implications for the oft-repeated call for greater diversity in CSD academic faculty (Nettles & Millett, 2006; Wright-Harp & Cole, 2008).

Multiple organizations have developed mentoring programs to support students from underrepresented racial and ethnic minority groups. Examples include the ASHA Minority Student Leadership Program (ASHA, n.d.-c) at the National ASHA Convention and the virtual ASHA Student Empowered Professional (S.T.E.P.) program (ASHA, n.d.-d). Both programs focus on encouraging individuals from racial and ethnic minority groups who have traditionally been underrepresented in CSD to enter and remain in the discipline. A PS-MMM has the potential to increase the diversity of students engaged in research and ultimately the diversity of individuals who become research faculty by increasing mentoring. Underrepresented students are expected to benefit from the general increase in the quantity and quality of mentored research experiences. In addition, the group mentoring aspects of a PS-MMM, which are not present within a traditional mentoring model, may be especially helpful. With access to a greater number of mentors (PhD students and faculty advisor), students are more likely to have the opportunity to build relationships with individuals who also identify with groups who have been

historically underrepresented in CSD. These relationships may have lasting positive impacts on the students' future.

Research labs also can support the participation of students from historically underrepresented minority groups through the content of their projects. For example, students who are bilingual may be especially interested in participating in a lab conducting research related to children or adults who are bilingual. The group mentoring model enables a lab to combine research expertise from the faculty advisor and students at multiple training levels. When a faculty advisor or PhD student does not have the exact expertise of a mentee's interest, a collaboration can be successful. Continuing the prior example, a faculty advisor with expertise in general child language but not specifically bilingualism can support and mentor a PhD student with an interest and expertise in bilingualism. The PhD student would provide expertise in bilingualism and assist the mentee in obtaining the necessary resources on bilingualism. The faculty member would provide expertise on child language and other necessary research expertise that is not topic specific (e.g., research design and analysis). The mentee receives the needed support for a meaningful, mentored research experience without impractical time and effort from the faculty advisor.

Enhancing Research Training for Undergraduate and Clinical Graduate Students Who Pursue Clinical Careers

Use of a PS-MMM provides undergraduate and clinical graduate students with meaningful, mentored research experiences to facilitate their success in clinical preparation programs and as consumers of evidence in clinical practice. Mentored research experiences provide important learning opportunities for students to become more successful graduate students and clinicians than they might be without such experiences. Learning opportunities include, but are not limited to, developing research questions, designing procedures, assisting with data collection, analyzing data, and disseminating findings under the direction of a mentor, often a faculty member. Aligning the goal(s) of a mentored research experience with a student's

current skills and goals increases the value of the experience for everyone involved. Adequate planning enables mentored research experiences to focus on clinical skills for students preparing for clinical careers (rather than research careers).

Undergraduate and clinical graduate students planning to pursue clinical careers can benefit from the increased quantity and quality of mentored research opportunities afforded by a PS-MMM. These opportunities are made possible by PhD students stepping into a mentoring role and assuming some of the responsibilities that faculty advisors would otherwise have to assume independently. The support of PhD students working within a PS-MMM may enable programs to offer mentored research experiences to students in clinical preparation programs who otherwise would not receive them (e.g., students not planning to seek a research doctorate or not completing a research thesis).

Even without pursuing a doctorate, students can use mentored research experiences under a PS-MMM to support the CSD discipline. For example, SLPs and audiologists integrating research findings into clinical practice can support narrowing of the wide research-practice gap and providing evidence-based services, not only for their own practice, but for other clinicians via leadership roles (Joint Ad Hoc Committee on PhD Shortages in Communication Sciences and Disorders, 2008). Additionally, many of the supervisory and interpersonal skills modeled by PhD student mentors directly apply to supervisory relationships in clinical settings. Students who experience a positive mentoring relationship through this model subsequently may develop high-quality clinical supervision skills. Such skills are essential to supporting the discipline of CSD more broadly because the mentee is likely to become a mentor in research and/or clinical settings.

Teaching PhD Students to be Research Mentors

When PhD students graduate and transition to faculty positions, they encounter multiple job responsibilities for which they have varying levels of preparation. Participation in a PS-MMM as a PhD student facilitates early career success for junior faculty. Mentoring students in

research experiences is a responsibility for which junior faculty members in CSD rarely receive

didactic training, much less hands-on experience during their PhD training (ASHA, n.d.-b). In a

sample of 227 PhD graduates, only 54% of respondents felt well prepared to mentor students,

regardless of their current position (Crais & Savage, 2020). This situation is perhaps not

surprising given that traditional PhD programs focus on coursework, research training,

comprehensive exams, and dissertation (ASHA, n.d.-b). However, given the myriad activities of

the research labs in which PhD students are trained, it is likely that PhD students can be

provided opportunities to develop their research mentoring skills so that they are better

prepared to succeed as junior faculty members.

Under a PS-MMM, PhD students learn to be research mentors through supported

opportunities to gain mentoring competencies (e.g., delegating tasks, clear communication, and

providing constructive feedback). These competencies are under-taught in graduate programs

(Abbott-Anderson et al., 2016) but sought-after for faculty careers. PhD students receive direct

and indirect support from the faculty advisor and the lab's other PhD student mentors. The

faculty advisor teaches the PhD student how to mentor effectively through direct instruction,

feedback, and modeling. In addition to hands-on mentoring, the PhD student observes how the

faculty advisor mentors the shared mentee(s). Over time, the faculty advisor offers the PhD

student more independence in mentoring.

PhD students who are well prepared with their faculty responsibilities are likely to be

more prepared to mentor more students and to do so more effectively. Thus, this next

generation of well-prepared early career faculty are ready to provide continued expanded

research mentoring opportunities for more undergraduate and clinical graduate students to

encourage more students to pursue research doctoral training and curtail the PhD shortage.

Successful early career faculty members are also more likely to achieve higher than average

research productivity. Such research advances the knowledge base of the discipline, a

necessary step for narrowing the research-practice gap and improving the quality of services that individuals receive from SLPs and audiologists.

Initial Creation of Our PS-MMM

A series of United States Department of Education training grants from 2008 to the present provided our faculty at Vanderbilt University and Vanderbilt University Medical Center added incentive to think carefully about how to best prepare PhD graduates to be exemplary teachers and exemplary researchers to address the PhD shortage. Our training grants have focused on the area of child language and literacy. The training grant program aims to prepare PhD graduates who will (a) advance the evidence base on meeting the needs of children with disabilities and (b) prepare special education and related services personnel to provide evidence-based interventions to children with disabilities. PhD training grant students contribute to reducing the shortage of professionals with a research doctorate to meet PhD-level faculty needs.

With respect to the two aims above, we aligned our training grant expectations with the research requirements of our PhD program – each student completed two predissertation research projects as well as a dissertation study. Ultimately the successful completion of these benchmarks is the individual student's responsibility. However, when our students who aspire to be exemplary researchers become new faculty members, they will need to manage a team of people. Team members may include other individuals with a PhD (e.g., co-investigators, consultants, and postdoctoral scholars) and students (e.g., PhD, clinical graduate, undergraduate, and high school students). Thus, we began to think about how to prepare our PhD students to lead research teams. As one avenue, we have training grant students support each other in completing their required projects (e.g., assist with data collection and reliability). As another avenue, we placed students in various leadership roles in what we call lab research projects (e.g., principal investigator-led funded projects). In time however, we realized that training grant students would benefit from explicit leadership experiences in mentoring more

junior students in the lab, including high school students attending the School for Science and

Math at Vanderbilt (Vanderbilt University, 2020), undergraduate students completing an honors

thesis, and speech-language pathology master's students completing a thesis. These

experiences led to the development of what we call a PS-MMM.

Development and Current Implementation of Our PS-MMM

Our lab continues to optimize a PS-MMM. Although the model initially included only a

few students, it is now *modus operandi* for the lab. Further, all students who choose to complete

a master's thesis in the department are offered the option of working with a PhD student mentor

in addition to a faculty advisor and the PhD student officially serves on the thesis committee. As

students at multiple training levels conduct projects at the same time in our lab, the model's

group mentoring features have become more apparent. The most common pairing in our lab is

a PhD student mentoring a master's student's thesis. A number of other arrangements have

also been successful with student mentees ranging from high school to clinical graduate

students. See Table 1 for selected case examples.

PhD students in our lab have each had unique mentoring experiences. For example, the

first author initially mentored a master's student in speech-language pathology for her thesis.

They shared a clinical and research interest in language intervention for children with hearing

loss (see Project 1 in Table 1). This mentoring relationship has extended past graduation to

prepare a manuscript for publication. Such mentoring for academic writing was not feasible

within the master's thesis timeline. The first author also mentored other students at varying

education levels either independently or in collaboration with other PhD students, including

students participating in Projects 3 and 4 described in Table 1.

Typically, PhD students begin mentoring in the second or third year of their program. But

the second author began her mentoring experience in the first year of her PhD program as an

opportunity arose with a master's student who had a shared interest. The PhD student and

master's student were interested in early literacy intervention for children with Down syndrome.

The PhD student's support of the project enabled the master's student to complete an intervention study in the summer of the first year in the master's program. Following defense of the thesis, the second author and mentee submitted a manuscript for publication with support from the faculty advisor (Hessling et al., 2021). In this project and subsequent projects, the second author trained and mentored undergraduate or clinical graduate students to complete procedural fidelity and interobserver agreement tasks. For some such tasks, the master's student assisted in training and overseeing an undergraduate student, thereby adding another tier to the mentoring model.

Another PhD student in the lab first mentored two undergraduate students for a non-thesis, mentored research experience. The undergraduate students were preparing to apply to speech-language pathology graduate programs and interested in learning about speech-language pathology and research. The PhD student then mentored a student for her master's thesis. Finally, the PhD student collaborated with a more junior PhD student to mentor another master's thesis project. The more junior PhD student was then ready to mentor another student independently in a subsequent semester. The collaborative mentoring of multiple PhD students for single projects increases the sustainability of a PS-MMM

Table 1

Case Examples of Research Projects Completed Under a PhD Student-Mediated Mentorship Model

	Project 1	Project 2	Project 3	Project 4
Faculty advisor	Professor in hearing and speech sciences with expertise in child language development and intervention	Professor in hearing and speech sciences with expertise in child language development and intervention	Professor in special education with expertise in intervention for children with developmental disabilities	Professor in hearing and speech sciences with expertise in child language development and intervention
PhD student(s)	First year student with expertise in child language intervention, including for children with hearing loss	First year student with expertise in child language and literacy intervention, including for children with Down syndrome	Second year student with expertise in child language intervention, including for children with autism spectrum disorder	Third year student and second year student with expertise in child language intervention
Mentee(s)	Master's student in speech-language pathology	Master's student in speech-language pathology	Undergraduate student (junior when initiated project)	Master's students in speech-language pathology
Type of project	Master's thesis	Master's thesis	Undergraduate honor's thesis	Supplemental project* developed through coursework
Project title	Language Profiles of Preschool Children with Hearing Loss	Phonological Awareness Intervention in Individuals with Down Syndrome	Early Intervention and Affect in Children with Autism	Strategies for Teaching Verbs to Children with Typical Development and Children with Down Syndrome

Brief description	This study explored the language variability of preschool children with hearing loss who had caught up to their hearing peers according to vocabulary measures. The participants (n = 15) completed a battery of 7 to 10 language and early literacy assessments, depending on age. Variability across measures and language domains were analyzed for the group and individual participants.	This study evaluated the effect of a phonological awareness intervention on phonological awareness skills of children with Down syndrome (kindergarten through third grade). The study used a multiple baseline across participants single-case research design. Participants received three 30-minute small group intervention sessions per week. The mentee and PhD student provided the intervention. Undergraduate students completed procedural fidelity and interobserver agreement tasks.	The student developed and used a coding system to compare the degree to which young children with autism spectrum disorder (n = 29) exhibited positive, negative, and neutral facial affect during early intervention provided in two different frameworks at two intensities. This project utilized video recordings from a multisite randomized controlled trial and included training another undergraduate student to complete interrater reliability.	Preschool children with typical development (n = 23) and school-age children with Down syndrome (n = 6) were taught novel verbs under three treatment conditions: syntactic, semantic, and combined cues. Each participant completed all three conditions and were assessed on receptive (identification) and expressive (labeling) performance for the novel verbs.
Project duration	1.5 years	1.5 years	2 years	2.5 years to date
Dissemination to date	Thesis document National ASHA Convention oral presentation Invited webinar Professional development presentations for local SLPs Manuscript in preparation	Thesis document Internal poster presentation National ASHA Convention poster presentation Manuscript published	Thesis document Internal poster presentation National ASHA Convention poster presentation	Poster presentations at two national conferences (including the National ASHA Convention)

Note. At the time the activities described in this tutorial took place, PhD students in the Department of Hearing and Speech Sciences at Vanderbilt University were required to complete two predissertation projects and a dissertation to meet the doctorate degree requirements. "Supplemental project" refers to an additional research project that did not fulfill a degree requirement. Since that time, departmental degree requirements have changed.

Observed Benefits of Implementing Our PS-MMM

As we implement and optimize a PS-MMM, we observe consistent benefits for mentees, PhD student mentors, and faculty advisors. This novel model has reduced or eliminated many challenges of the traditional mentoring model. A PS-MMM offers multiple access points to engage with mentors who may embody the qualities of successful mentors, rather than relying on a single individual. Sharing mentoring responsibilities among different levels of command allows each person to use their resources efficiently and benefits all stakeholders.

Faculty Advisors

Faculty advisors can engage with students at a higher-level more consistently because PhD student mentors oversee day-to-day research tasks. Our lab has been able to accept more requests for mentored research experiences under a PS-MMM. Nearly all students mentored through a PS-MMM in our lab have completed their projects, many have presented their projects nationally, and several are preparing manuscripts for publication. The model also has enabled some students to complete larger scale projects than would otherwise be feasible.

PhD Student Mentors

With hands-on mentoring experience that includes direct guidance from the faculty advisor and feedback from the faculty advisor and mentee(s), PhD students have cultivated and refined marketable skills that contribute to their competitiveness as job candidates and their success as junior faculty members. Mentoring students within their PhD program prepares junior faculty for creating student research experiences that support their broader research agenda, rather than interfering with it. These junior faculty members can be ready to mentor students earlier in their careers than same-level colleagues without comparable mentoring experiences. Mentoring students can accelerate a lab's research activities and support the department's need for mentoring students at varying educational levels (e.g., undergraduate,

graduate, PhD, and postdoctoral). PhD student mentors have benefited from the lab's expanded

research activities by participating in a greater number of and diversity of research projects than

otherwise available. For example, many of our PhD student mentors have participated in a

combination of single case and group design studies, both of which align with their research

goals. They also have presented more posters and oral presentations than we generally expect

of PhD students. Thus, the PhD students' mentoring experiences have translated into tangible

work products that have made them competitive candidates for faculty positions.

Mentees

A number of mentees have continued to engage in research and/or are planning to

pursue additional research training. The first master's student to participate entered our PhD

program after her clinical fellow experience and is now a junior faculty member. Several recent

mentees engage in clinical research as SLPs at pediatric medical centers. Some of these prior

mentees now mentor students assisting with their clinical research. Another mentee intends to

enter a research doctorate program in speech-language pathology upon completion of her

clinical fellowship. Participation in a PS-MMM prepares mentees to be future mentors as PhD

students or through other positions. As a mentee in a PS-MMM, they have learned what it is like

to be mentored, experienced how their PhD student mentor approaches mentoring, and likely

observed other PhD student-mentee pairs interacting as well. In sum, students have not only

continued to engage in research but also advanced their research skills beyond the mentored

research experiences they completed through a PS-MMM. Importantly, mentees have

matriculated in PhD programs, which addresses the PhD shortage and may have been

positively influenced by participation in a PS-MMM.

<div align="center">

Addressing Challenges of Implementing a PS-MMM

</div>

A PS-MMM is not without challenges. As expected, some students did not complete their

projects, but this challenge has been minimal. For example, we have observed a couple

students lose interest in their project or have competing demands on their time that prevented

them from completing their project. It is important to create mentored research experiences that are of appropriate scope for the mentee and mentors. Everyone involved must be aware of and able to commit the necessary time and resources for completing the project. As shown in Table 1 and other examples, mentees can be involved in research to varying degrees (e.g., master's thesis versus a research assistant for a supplemental project). Explicitly discussing the available opportunities and the accompanying responsibilities and supports before committing to a research experience increases the likelihood of success and maximum benefit.

Because the mentee receives input from multiple mentors, the mentee may receive conflicting directions and feedback that can slow or derail a project. For example, the PhD student and mentor may provide different responses when a mentee asks about specific study procedures or how to structure a written document. Explicitly dividing mentoring responsibilities and establishing clear expectations for how and when the mentee and mentors should communicate (e.g., in person versus email) helps minimize this risk. Establishing effective, efficient communication is especially important under a PS-MMM because coordinating meetings between three individuals is more difficult than between two individuals as in the traditional model. Having effective pathways for mentees to ask questions and receive feedback is critical to the project's success. Relatedly, it is important that the mentee, PhD student mentor, and faculty advisor also receive appropriate credit for their roles on the project. To support this need, each lab member signs a lab authorship and data access policy as well as an authorship agreement for each work product (e.g., poster presentation, oral presentation, and manuscript). We find the conversations surrounding these documents to be incredibly helpful in setting appropriate expectations for who is responsible for which contribution to the product and how authorship may be adjusted based on performance completing such tasks.

Suggestions for Developing a PS-MMM

The flexibility of a PS-MMM enables faculty members and administrators to adapt to changing needs of students and faculty members. These changes may occur within and across

programs over time. For example, we adjust the number and arrangement of PhD student-mediated mentoring relationships each semester based on the number of students at each training level in the lab. CSD programs vary in their ratios of PhD, master's, and undergraduate students. For some universities, PhD students may be more likely to mentor undergraduate than clinical graduate students because of the relatively greater flexibility in schedules of undergraduate students for mentored research experiences or the number of undergraduate students. In the following paragraphs we give readers an outline to adapt to initiate and scale up a PS-MMM in their own labs. When initiating a PS-MMM, you can focus on the mentee, PhD student, lab, or department level depending on your role (e.g., faculty member versus department chair) and responsibilities as well as your department's needs.

Step 1: Identify Who Would Benefit From and/or Has Expressed an Interest in Receiving Research Mentoring

These individuals often include undergraduate and clinical graduate students. Clinical supervisors or clinicians at a university clinic or other local center or school may also express interest in engaging in research and request support in doing so. Below we describe an example of using a PS-MMM for a collaborative research project in which two clinicians with a clinical question initiated the project. Use of a PS-MMM is expected to grow over time rather than being fully implemented at initiation. Not all available mentees are expected to be offered mentored research experiences in the first semester. You may choose to focus on one population of mentees first and then expand to another (e.g., begin with undergraduate students and then expand to clinical graduate students). Alternatively, you initially may choose mentees at varying career stages to increase the cascading effects across the lab. You also could select initial mentees based on other criteria (e.g., research interests, past research experience, or time to devote to the project) and expand the number of mentees over time using similar criteria.

Step 2: Identify PhD Students Who Can Serve as a Mentor

We have found the model to be especially beneficial when the mentee and mentor have a shared interest (e.g., language intervention for children with developmental disabilities or children who are deaf and hard of hearing). You may consider seeking potential mentees based on the expertise of PhD students in your lab. Conversely, you may consider approaching PhD students within or possibly outside of your lab who share interests of potential mentees to serve as mentors.

Step 3: Match the Currently Available Mentees and Mentors

As mentioned above, we have found a shared interest as a helpful feature for pairing mentees and mentors, but that is not the only factor to consider. Other factors include how much time the PhD student can devote to mentoring, alignment of the mentee's and mentor's schedules for meeting and completing necessary tasks, and whether the PhD student will be available until the project is completed (or can transition the project to another PhD student mentor upon graduation).

Step 4: Train PhD Students to be Effective Mentors

To prepare PhD students for serving as mentors, we have found it helpful to have a more junior PhD student at least observe if not formally participate with a more senior PhD student mentoring a student for a semester or year. This observational or training period enables the junior PhD student to understand and plan for the mentoring process. Such planning includes self-evaluation with feedback on what mentoring skills the PhD student already possesses and what skills they need to develop. Subsequent training is tailored to the student's strengths and needs. We have found 5-year career plans and individual development plans to be helpful tools for framing these reflections and conversations. For example, a PhD student can share early on in their training that they are interested in mentoring and then add tailored training activities for that goal. Many universities, funding agencies (e.g., National Institutes of Health), and career support centers (e.g., http://myidp.sciencecareers.org/) provide

templates for these plans. Explicit training on mentoring including directed readings on

mentorship (e.g., *Making the Right Moves*; Burroughs Wellcome Fund and the Howard Hughes

Medical Institute, 2006; *How to Mentor Graduate Students: A Guide for Students*; Rackham

Graduate School, 2020) and empirical articles on mentoring (e.g., Dolan & Johnson, 2009;

Pfund et al., 2016) have benefited our lab. Commercial mentoring curricula (e.g., *Entering*

Mentoring; Branchaw et al., 2019; Pfund et al., 2014) are also available. When possible,

consider training PhD students in small groups, within or across labs, to reduce the amount of

time required by faculty members and to encourage PhD students to support one another. Also

explore university resources, such as those from centers for teaching and the graduate school.

Step 5: Expand the Number of Mentees and PhD Student Mentors Involved

The observational or training period described above not only has improved the PhD

students' skills, but we have also noticed PhD students being more willing to engage in

mentoring tasks once they have seen the benefits. Once the initial PhD student mentors and

their mentees are established, transition the PhD student who is in the supportive mentoring

position (e.g., secondary mentor) to more independent roles. Although transitioning

responsibilities may occur relatively naturally, it is important to plan for such transitions and to

be explicit about the role of the PhD students, mentees, and faculty mentor, especially when

first committing to projects. We have observed an increase in the overall number of

undergraduate and clinical graduate students interested in participating in our lab's research as

they observed other students doing so. Thus, recruiting student mentees has been a strength of

the model, not a challenge.

Step 6: Support and Encourage Other Faculty Members to Implement a PS-MMM in Their Labs

Expanded implementation of a PS-MMM across labs may occur naturally to some

degree when PhD students work in multiple labs. For example, a PhD student learned how to

mentor a master's student under a PS-MMM in our lab. She then established a similar approach

when mentoring an undergraduate student for an honor's thesis within another lab in which she

worked. She shared a PS-MMM with a faculty member who was previously unfamiliar with, but

open to, a PS-MMM. It is expected that some effort will be necessary to encourage increased

participation from faculty members to engage with more PhD students as mentors and more

junior students as mentees. For faculty members already mentoring students, support could be

provided in how to implement a PS-MMM to increase the number of students mentored in their

lab. For faculty members not actively engaging in research mentoring for undergraduate or

clinical graduate students, support could focus on how using a PS-MMM enables the faculty

advisor to share mentoring responsibilities with the PhD student. This support may result in the

mentoring commitment being less intimidating.

Step 7: Consider and Include Students and Professionals Outside of the Faculty Member's Lab

Our lab has adapted our PS-MMM for projects beyond the now routine master's thesis

project. For example, we partnered with a teacher of the deaf and a SLP from an on-campus

preschool for children with hearing loss to compare monolingual (English-only) versus bilingual

(Spanish-English) vocabulary instruction for preschool children with hearing loss who speak

Spanish and English. Two PhD students and a faculty advisor mentored the two clinicians. One

PhD student and the faculty advisor exhibited expertise in the appropriate study design for their

research questions (i.e., single case research) and in language development of children with

hearing loss. The second PhD student, from a different lab in the department, exhibited

expertise in children with hearing loss from an audiological perspective and in bilingualism. Two

additional audiology graduate students participated in the project to complete procedural fidelity

and interobserver agreement tasks. Thus, components of a group mentoring model were

implemented even though this team was conducting a single project. There does not have to be

a one-to-one relation between mentees or PhD mentors and research projects. By defining

responsibilities and communicating clearly the group functioned well as an effective team.

Similar adaptations for a PS-MMM could be achieved through partnering with clinicians at

university speech-language-hearing clinics or clinical supervisors who supervise students off-

campus. For example, a PhD student may pair with a clinical supervisor to answer a clinically

relevant question with an undergraduate student serving as a research assistant and a faculty

member being the faculty advisor. These types of projects provide opportunities for PhD

students to gain experience mentoring and implementing research studies in applied settings.

They provide clinicians with opportunities to answer research questions highly relevant to their

daily practice and to better understand the research process.

Future Directions

Future research should formally examine the benefits of PS-MMMs. Such research may

incorporate qualitative (e.g., structured interviews) and quantitative methods (e.g., surveys and

objective outcomes such as degree obtainment; Dolan & Johnson, 2009; Kim et al., 2013).

Short-term benefits (e.g., students' degree of satisfaction, scale of completed projects, and

number of individuals involved in research) as well as long-term benefits (e.g., students'

completion of more advanced degrees and PhD students' and faculty advisors' degree of

participation in future mentoring and research productivity) should be considered. Additionally,

identifying which aspects of research mentoring relationships are critical for positive outcomes

will facilitate optimization of the model by prioritizing necessary features. This body of research

is only emerging (e.g., Feldon et al., 2019; Pfund et al., 2016).

Conclusion

Our PS-MMM has developed over recent years as a component of a series of PhD

Leadership Grants from the United States Department of Education. The model addresses

pressing challenges facing the discipline of CSD, especially the shortage of PhD-prepared

persons to hire into faculty positions and the wide research-practice gap. Under the model, PhD

students learn research mentoring skills critical for success in faulty positions, and

undergraduate and master's students gain access to more research mentoring experiences of

greater quality that may encourage them to transition into research doctoral training as well as

address the research-practice gap in their clinical careers. Despite variation in the details of

specific mentoring relationships, we have seen consistent, positive benefits for mentees and

mentors under our recently developed mentorship model. The flexibility of PS-MMMs supports

the potential for widespread use with specific applications tailored to individual universities,

departments, and labs.

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