Implementation of a Student Research Group With Undergraduate Preservice Teachers

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Abstract
The purpose of this paper is to describe the implementation of an undergraduate student research group with preservice teachers at a university in the Northeastern United States. Following the guidelines of Shanahan et al. (2015), university faculty provided intensive mentoring, scaffolded support, and instruction related to research evaluation and methodology. Undergraduate students completed literature reviews of a specific topic related to education and conducted their own research studies. This article describes a model of undergraduate research the authors developed for elementary and special education preservice teachers.

Keywords
undergraduate research, teacher education, mentoring, student research

The Council on Undergraduate Research (2021) defines undergraduate research (UR) as "[a]n inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline" (para. 4). Undergraduate research has primarily been supported in the science fields with more recent expansion to mathematics, social sciences, arts and humanities, and professional disciplines (Crawford & Shanahan, 2014). However, the literature related to UR still remains sparse in the field of teacher education. The purpose of this article is to present a model of UR for teacher education faculty and pre-service teachers (PSTs) and to share the challenges and successes of engaging in UR. This article expands on past research related to UR by including experiences with

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PSTs.

Supporting PSTs in UR addresses the goal of teacher education programs to develop students into teachers who successfully demonstrate the Interstate Teacher Assessment and Support Consortium (InTASC) standards which outline what teachers should know and be able to do (Council of Chief State School Officers, 2011). Specifically, UR supports Standard #4: Content Knowledge by helping the PST to understand that the teacher's content knowledge is constantly evolving, and it is the teacher's responsibility to stay informed and current regarding new ideas in their field. Additionally, UR supports Standard #6: Assessment by teaching PSTs to apply the data collected from research to help make data-based decisions regarding instruction. Standard #9: Professional Learning and Ethical Practice is also supported through UR by encouraging PSTs to be life-long learners constantly on the quest for new knowledge.

Institutes of Higher Education (IHE) benefit when participation in UR is offered to their students. UR is identified as a high-impact practice by the Association of American Colleges and Universities as it supports increased retention and graduation, as well as increased enrollment in graduate education (Council on Undergraduate Research, 2021). In addition to these critical benefits related to higher education, UR also promotes an innovation-oriented culture (Council on Undergraduate Research, 2021).

Literature Review

Benefits of Undergraduate Research for Students

Engaging in UR helps prepare PSTs for their future careers as teachers by developing a continuous learning and inquiry-based mindset. This is accomplished by encouraging the PSTs to explore research questions related to areas of personal and professional interest. As PSTs develop a passion for research, their mindset shifts from a focus on mastering their coursework to the development of an inquiry-based mindset. By introducing the PSTs to conferences, journals and other scholarly resources, they begin to acquire the tools to help them become lifelong continuous learners. Additionally, examining research questions prepares the novice teachers to conduct action research that leads to data-based decision making in their future classrooms.

Student benefits from engaging in UR include intellectual gains, enhanced career preparation, critical thinking, creativity, problem solving, intellectual independence, increased perceived research competency, and an understanding of research methodology (Council on Undergraduate Research, 2021; Davis & Jones, 2017; Hammack et al., 2017; Hayward et al., 2017). Additionally, Hammack et al., 2017 identified benefits for students, which align to goals of teacher education programs, such as increased content knowledge, practical application of knowledge, and improved professional dispositions. UR for PSTs not only improves student performance in their undergraduate program, but it can also improve their future teaching. For example, Hobson et al. (2015) included undergraduate teacher education students in research through coursework and research symposiums. They identified goals for engaging teacher education students in UR such as to develop research skills that they can apply to their future teaching, use research to evaluate their own teaching practices, help students connect theory to practice, implement research-based teaching practices, make connections between their personal interests and future profession, contribute to the knowledge-base in education, foster lifelong learning, prepare for graduate work, and to disseminate their findings (Hobson et al., 2015).

Additionally, when PSTs participate in UR, they engage in professional learning, which is a requirement of the Council for Accreditation of Educator Preparation (CAEP; 2020) standards.

Benefits of Undergraduate Research for Faculty

Faculty become involved in UR because they are motivated by both intrinsic and instrumental motivations when working with undergraduate students on research projects (Hayward et al., 2017). Intrinsic motivators include a desire to support the development of the workforce, wanting to serve in a mentoring role, and enjoyment from working with undergraduates. Instrumental motivators include increased productivity, requirement of job or position, and help with checking work. Whether the motivation is intrinsic or instrumental, working with undergraduate students on research projects offers the mentor a wide range of benefits.

Faculty involved with UR benefit by developing future talent, facilitating productive interactions with diverse students, generating meaningful scholarship, and improving their own instructional practices by developing an understanding of undergraduate students' emotional and academic needs (Hammack et al., 2017; Morales et al., 2017). Hayward et al. (2017) examined the benefits of working with UR for 30 faculty mentors in the STEM fields. They identified both intrinsic and instrumental benefits. Intrinsic benefits included improved teaching and mentoring skills, personal rewards (i.e., friendship, feeling of doing something good), deeper understanding of scientific concepts, contributions to preparing future scientists, increased energy and enthusiasm in the lab group. Instrumental benefits included increased productivity, career development (i.e., CV building), prestige for the university or lab, and help in recruiting future students (Hayward et al., 2017). Both intrinsic and instrumental benefits present opportunities for the mentor to develop their teaching, scholarship, and service contributions.

The benefits that mentors experience when working with UR vary depending on the relationship between the mentor and student as well as the format of the research project. For example, Morales et al. (2017) examined 468 faculty members across 13 research-intensive institutions to identify the benefits for biomedical faculty when working with UR. Their findings indicate that faculty mentors were more likely to publish work with undergraduate students when they worked with the student for more than one year, enjoyed teaching students about research, had experience mentoring Black students, received funding, had a high rate of publication and citations, and had more experience in higher education.

Strategies to Support Undergraduate Research

The benefits of UR for students and faculty are gained through high quality active mentoring (Shanahan et al., 2015). Mentors need to do more than just meet with their mentee and answer their emails; they need to be active mentors. In examining the relationship between 69 undergraduate researchers and their mentors, Davis and Jones (2017) found that active mentoring is needed in order to build undergraduate students' perceived research competency. Active mentoring involves the mentor being engaged with the mentee throughout the research process by modeling how to conduct research, develop questions related to their topic, and defend their work (Davis & Jones, 2017). Additionally, effective active mentors help students develop a sense of ownership of the work, deep satisfaction, and high levels of self- efficacy (Hammack, et al. (2017).

When UR involves an interdisciplinary project, more than one faculty member may mentor a student in a multi-mentoring team (Bradley et al., 2017). Multi-mentoring teams present unique challenges related to consistent communication and expectations across mentors. Bradley et al. (2017) recommends addressing these challenges through collaborative mentoring where the mentors work together to ensure they are providing the student with clear and consistent messages and support.

Shanahan et al. (2015) and Walkington et al. (2020) identified ten salient practices of UR mentors: (1) Strategic pre-planning to support students' varying needs and abilities during the research process. This includes spending time with the student early in the research process to assist with topic selection, planning, and setting achievable timelines. Additionally, mentors need to learn about their student's level of preparation, motivation, and skills; (2) Setting clear and well-scaffolded expectations. This practice addresses the need to adjust the level of support based on the student's skills and needs as well as the stage of the research process. The level of support fluctuates throughout research stages with some students needing different levels of support at each stage. Typically, there is a gradual release of support from the mentor with high levels of support at the beginning stages with a transfer of responsibility to the student as the project proceeds. It is also helpful to provide the student with clear expectations at the start of the project; (3) Teaching the technical skills, methods, and techniques of conducting research in the discipline. Undergraduate teacher education programs may not include an emphasis on research methods and procedures until upper level coursework begins. Therefore, engaging lower level undergraduate students in research requires mentors to instruct students in research methods including ethical standards; (4) Balancing rigorous expectations with appropriate emotional support. This practice requires the mentor to develop a relationship with the student in order to understand the student's personal needs to be successful. For example, some students need frequent check-ins regarding their emotional and academic needs. All students should be provided with positive, constructive, and frequent feedback to assist them throughout the research process. Mentors should also present themselves in an approachable manner to avoid student anxiety; (5) Building community. Whether the research involves a team or is a one-on- one endeavor with a student, the mentor should work on supporting connections with the student to help build trust; (6) Dedicating time to one-on-one mentoring. Time spent working individually with a student will offer the mentor an opportunity to adjust their level of support and develop specific goals for both the research project and the student's skill development; (7) Increasing student ownership over time. Students should be given the opportunity to understand how their role contributes to the project and they should have a voice in the research process. Mentors should allow students to ask questions, select research topics, and share their thoughts.; (8) Supporting students' professional development. Mentors should help students make connections with other professionals in their field of interest on campus, in the community, and at conferences; (9) Creating opportunities for peers to mentor each other. During peer mentoring, the faculty mentor models effective mentoring skills for the peer mentor to emulate when engaged in their own mentoring; and (10) Encouraging students to disseminate their findings. Mentors should assist students with attending conferences, developing proposals to present at conferences, and possibly writing manuscripts for publication. This practice is important for students to help them understand that one purpose of research is to share new findings with others.

Development of the Student Research Group

The purpose of this article is to describe the development and implementation of a student research

group (SRG). Two faculty members at a university in the Northeast developed the SRG to promote student engagement and foster critical thinking skills. These faculty members both had doctorates in a field related to education (e.g., special education, educational psychology) and had experience conducting research. Additionally, they were both first-year faculty members at the start of this group. These faculty members served as active mentors throughout the implementation of the SRG.

The goal of the SRG was to form a team of students who could learn how to analyze research and conduct practitioner-related research studies on the university's campus and in the field (e.g., K-12 schools). Mentors selected the undergraduate students based on a variety of factors including the students' abilities to (1) manage time; (2) work effectively with others; and (3) balance the requirements of the SRG with coursework and other responsibilities. The SRG did not replace any course requirements or practicum experiences. Instead, the work of this team was in addition to the other requirements students had while enrolled in college.

Participants included undergraduate students enrolled in a teacher preparation program at a university in the Northeastern United States. All participants were in their second or third year of college and were working towards a bachelor's degree in childhood education at the time of this study. During the first year of implementation, the SRG included seven undergraduate students, all of whom were enrolled in the five-year BA/MA childhood and special education program.

Before inviting students, mentors met routinely to outline the purpose of the SRG, as well as to plan the sequence of tasks students would need to complete. It was determined that the focus of the first semester would be on analyzing current literature about a topic related to education. Based on this, the mentors utilized the steps of effective mentoring for undergraduate students as described in Shanahan et al. (2015). The steps were followed in order (i.e., pre- planning occurred first) and the faculty collected anecdotal feedback throughout the entire process.

Pre-Planning

To begin the development of the SRG, the mentors met throughout the semester before implementation. The goals of the SRG and timeline were considered. The mentors decided that, in addition to goals related to engagement and critical thinking skills, it would be beneficial if the students submitted a conference proposal after the first semester. This seemed like a reasonable, feasible goal that could be accomplished in just a few months. Therefore, the mentors researched conferences in the surrounding area that would support practitioner work, as well as undergraduate students. Once the conference was determined, the mentors utilized backward planning to outline the sequence of tasks needed to achieve this goal.

Additionally, during this step, the mentors devised a list of students who they believed would be interested and successful in the SRG. Students were formally invited and participated in a meeting prior to the start of the SRG in which the mentors explained the rationale and required workload associated with this opportunity.

Scaffolded Expectations

Throughout backward planning, the mentors outlined key milestones for the development of a conference proposal including the (1) identification of peer-reviewed research; (2) evaluation of current research; (3) development of a literature review; (4) analysis of conference proposal requirements; and

(5) submission of proposal. Mentors scaffolded the expectations for the students into smaller chunks of knowledge and skills. Students were provided an outline of expectations during the first meeting. Table 1 has a sample of these expectations. This served as the student contract.

Table 1
Sample SRG Schedule

Meeting	Topics	Assignment Due After Meeting
1	What is SRG? Topics of Interest PowerPoint & Matrix How to find articles	Touch base with your mentor before the next meeting about journal articles (bring 5 articles for approval). Bring two completed Matrices to the next meeting
2	APA format Matrix, continued	Touch base with your mentor. Bring all completed Matrices to the next meeting
3	Introduce Conference Proposals Work time	Complete proposal before the next meeting. Bring a draft of this proposal to next meeting.
4	Editing and revising proposals	Finalize proposal. Bring final to the next meeting.
5	Submit proposals	Send confirmation of proposal to Mentors

Teaching Research Methods

The first part of this step required the mentors to explicitly teach the undergraduate students how to locate peer-reviewed articles using the library's databases. The mentors provided an in-person tutorial and a step-by-step handout for students. The types of articles (e.g., practitioner, research) were also discussed. For the purpose of the literature reviews, students were required to find 10 research peer-reviewed journal articles, although they could use additional sources (e.g., websites, practitioner articles) if needed.

Then, the mentors outlined the different components of research articles (e.g., participants, setting, method, results). After discussing the significance of each component, the mentors also described the typical layout of articles and where to find such information. Students were provided a matrix to help them glean the required information from each article. Students were provided prompts to evaluate each component of the articles. A list of sample prompts is provided in Table 2. Finally, students were given a guide related to APA formatting to help them cite each source on the matrix and, later, their literature reviews and conference proposals.

Rigorous Expectations & Emotional Support

Students were encouraged to develop their own topics to explore, and they could pick any topic in the field of education. Mentors helped narrow down broad topics (e.g., teaching reading to students with disabilities). This helped focus the students' literature reviews and made the project seem more manageable to students. Student choice also motivated the students to participate.

Furthermore, the mentors supported students through one-on-one meetings to provide specific, detailed feedback. Students also submitted multiple drafts of their matrices, literature reviews, and proposals for review by the mentors. Although the timeline and tasks were rigorous, individualized

support was provided to each student.

Table 2.
Example Prompts & Components of Matrices

Components of Article
1. Article Citation in APA
2. Information from the Literature Review- What are the main ideas to support this study or provide context?
3. Research Questions - What is the purpose of this study?
4. Participants- *(N* = total # of participants for entire study; *n* = total # of students for specific group of students in the study [control group and intervention group])
5. Setting- Where does this article take place?
6. Method- What is the design of this study (single subject, group, experimental, case study, qualitative)? What are the dependent measures (i.e., how are they measuring results – typically a test, survey, interview, etc.)? What are the independent measures (i.e., describe the intervention)?
7. Results- What are the results of this study?
8. Discussion- Do the results support the research questions, literature review, and/or author hypothesis? Are there any limitations of this study?

Building Community

During the first semester of the SRG, almost all of the students worked in pairs and they selected a topic to explore together. This also helped decrease the workload while they were learning these new knowledge and skills. Each pair was still only required to find 10 journal articles to analyze, thus reducing the workload for each team member in half.

One student requested to work individually on the literature review and conference proposal. The mentors allowed this as they believed this student could handle the workload. Students also participated in bimonthly team meetings to help build community. The mentors frequently referred to the students as *scholars* to note the prestige of being selected and being a member of the SRG.

One-on-One Mentoring

Throughout the development of the literature reviews and conference proposals, the students attended one-on-one meetings with their mentors. The feedback varied depending on the needs of the students and pairs. Generally, mentors helped the students select the main ideas from the literature they reviewed. They also provided guidance related to writing style. This was often the first attempt at writing for technical purposes for students. Therefore, mentors focused the one-on-one meetings on APA formatting (both references and in-text citations) and overall sentence structure and grammar usage.

Because there were two mentors, the students were assigned one mentor for the purposes of the one-on-one meetings. Assignments were based on student topic. Students who explored topics related to students with disabilities were assigned to the mentor with special education experience, while the

students exploring topics related to general education were assigned to work with the mentor with elementary education experience.

Student Ownership

Students were encouraged to work with a peer during the first semester in the SRG. This helped reduce the workload and make the development of a conference proposal more manageable. After their first semester, however, students were encouraged to work independently. This promoted student ownership of the projects.

Supporting Students' Professional Development

The goal of the SRG was a conference proposal, and, later, a conference presentation. This conference provided students the opportunity to network with other undergraduate and graduate students, as well as local researchers, practitioners, and scholars in the field of education.

Opportunities for Peers to Mentor

After the first semester of work in the SRG, students were also encouraged to mentor the new participating students. The mentors were assigned a pair to help with each step of the SRG process (e.g., finding articles, developing proposal). This provided students the opportunity to give feedback to peers. Additionally, some students remained mentors even after graduation. They continued to provide feedback to SRG members virtually.

Dissemination of Findings

All SRG members were required to present their literature reviews at state-level conferences the semester after they submitted their proposals. Students worked with their partners to develop posters to present at these conferences. If the students submitted the conference proposal without the help of a peer, they presented independently at these conferences. The mentors also attended these conferences to help facilitate the poster sessions.

SRG members who designed and implemented their own research studies presented at national conferences to disseminate their findings. Conferences were related to teacher education. These students also developed poster presentations with the help of the mentors.

Current Status of the SRG

The SRG continued after the initial semester. The majority of the students continued participating in SRG (with new topics each year) until they graduated. After the first semester of participation, returning members were encouraged to develop a literature review independently and without the help of a partner. These students still received support from the mentors, however. New members were invited using the same criteria described above. On average, 10-12 undergraduates participated each year. The dissemination of findings also expanded with the development of a College-wide symposium, which was open to all students in teacher education to participate and attend.

Additionally, three students went beyond the development of a literature review and designed their own research studies. One student explored preservice teacher self-efficacy related to classroom and behavior management. The mentors helped this student identify the dependent variables, recruit participants, devise the methodology to collect data, and analyze data to present the findings. This student and mentors presented at a national teacher preparation conference about this study. A second student designed a study related to social-emotional learning in preschoolers with disabilities. Similarly, the mentors helped design the study and analyze data. This student received a grant to implement this study, which included salary and materials/supplies. A third student designed and conducted a study examining the relationship between math anxiety, instructional self-efficacy, and student math achievement. This student collected data from in-service teachers and their students at a local elementary school. The student presented the findings at a state conference and the student and mentor are in the process of co-authoring an article to disseminate their findings.

Some changes to the SRG did occur after the initial semester. One of the mentors moved to another institution in the Southeast after about two years of work in the SRG. This faculty member continued the SRG at the other institution using the same steps and guidelines outlined by Shanahan et al. (2015). The SRG at the institution in the Northeast continued as described in this study. An additional mentor was recruited from the school psychology department.

Experiences of Preservice Teachers and Faculty

The goal of the SRG was to promote engagement and the development of critical thinking skills in undergraduate preservice teachers. Anecdotally, the SRG was beneficial for all stakeholders including students and faculty.

Feedback from Students

The SRG promoted the development of knowledge and skills related to current evidence- based practices, and helped the students analyze how to implement such practices in K-12 schools. The skills gained through participation of the SRG helped the undergraduate students (1) learn the importance of research; (2) network with other professionals; and (3) become more motivated to be educators.

First, students actually used the practices they examined in the field. They began implementing the practices during their practicum and internship experiences. For example, one of the students in the SRG investigated mindfulness practices and its use in schools. She later implemented "Mindfulness Mondays" in her internship class, a strategy the classroom teacher has since continued.

Secondly, students were able to network with other professionals. The highlight of the SRG for the students was presenting at the state and national conferences. Students felt valued and heard at these venues. Other professionals (i.e., current teachers and administrators) encouraged the students and were so welcoming. One student noted "I felt like I was just a part of the best professional development imaginable." Furthermore, one of the students received an interview opportunity after presenting her work. These opportunities likely would not have occurred during undergraduate work without participation in the SRG as many of the students would not have attended these conferences.

Finally, students also noted the impact the SRG had on them personally, specifically in the area of motivation. It seems this group sparked not only their interest in various educational topics, but also increased their confidence. Training undergraduate PSTs to become highly efficacious teachers is an

important component of teacher preparation programs.

Experiences of Faculty

The SRG also provided the faculty mentors with several benefits. First, the faculty were able to work one-on-one and in small groups to tailor and individualize support. This helped them provided specific feedback about different aspects of the students' analyses, reviews, and findings. Next, the faculty members were able to build rapport with the rising scholars. The SRG was a community and faculty members were able to be personally invested in the professional lives of their students. The active mentoring required significant time and contributions, but it also allowed for the faculty and students to collaborate together as a team. Finally, faculty benefitted by adding to their curriculum vitas (CVs). They co-authored publications, co-submitted grants, and co-presented with students at conferences, all of which can be included for promotion and tenure and annual evaluations within their IHE.

Personal Reflection of a PST Member of the SRG

This section, written by a former member of the SRG, describes the experience of one PST as she engaged in UR. The path to becoming an educator can be one that challenges and rewards a college student. I was privileged to have numerous opportunities presented to me in which I was able to learn and grow as an educator in ways that I previously couldn't have imagined. The mentorship and collaboration among my peers, professors, and educators already in the field was an experience that has proven to be irreplaceable. I was able to collaborate and receive support from one of my professors in the Education program that resulted in a magnificent mentorship that I can bring into my profession post-graduation. Because of this mentorship, I have had the opportunity to conduct and assist with various research endeavors, present at and attend education conferences, and make connections within the professional field. This experience provided me with a feeling of preparedness as I step into the professional role as a special education teacher and gave me a feeling of confidence and improved time management. Additionally, I feel more involved in the professional education community, as well as more prepared in the creation of documents (e.g., data sheets and individualized academic materials) for my students.

Being involved in UR gave me insight and knowledge that I feel extremely confident that I will carry with me throughout my time as an educator in the special education field. I have discovered resources that I will be able to use and professionals within the education community that I will have support from as needed- especially during my first year of teaching. As a first- year teacher, I feel more at ease simply knowing that I have mentors and professional contacts that I can rely on to answer any questions I may have. If I were given the chance to have this experience again, I wouldn't change a single thing about it, I am grateful that I was able to receive the mentorship I experienced and I hope that more students will be able to have similar experiences in the future to help prepare them as future educators.

Discussion

Shanahan et al. (2015) provided ten recommended practices to develop and promote UR. These practices provide a scaffolded approach to implementing UR in IHE with the support of faculty mentors. This article described how two faculty members used these guidelines to develop an SRG with

undergraduate PSTs.

The development and implementation of the SRG provided active, structured mentoring to undergraduate students. This benefitted the students by providing strategies to analyze research, which they can generalize and use when they become beginning teachers in the field. Educators often hear about the "research to practice" gap. Educators and districts must continue professional development to stay abreast of evolving and new tools and strategies. The SRG provided PSTs with tools to continue to learn and keep up to date with evolving educational practices, even after graduation. Educators who have these skills can continue lifelong learning and professional development without the support of their school districts. They can, instead, find research on their own, analyze its effectiveness, and determine ways to apply the research to real-world settings. These skills are invaluable for beginning educators.

After the first year of implementation, there were some changes to the SRG as described above. The number of participants increased to about 10-12 each year. This meant the mentors had to provide support to more students, thus impacting time management. However, this also increased the number of co-authored publications and co-presented presentations for the faculty members' CVs.

In the future, the faculty would like to develop methods to quantitatively analyze the impact of the SRG on PSTs after graduation. For example, are the SRG members who have graduated implementing evidence- and research-based practices in their classrooms as the full- time teacher of record? Are they using the knowledge and skills acquired in the group to find best practices? Finally, are they teaching their own K-12 students to think critically? Faculty will be exploring ways to measure these types of data in the future.

Conclusion

The development of the SRG is backed by research and is supported by InTASC and CAEP standards. Specifically, the implementation of such a group was based on the recommendations of Shanahan et al. (2015). Students benefitted from the implementation and gained knowledge and skills they can use and generalize in K-12 settings. This can potentially help reduce the "research to practice" gap.

Declaration of Conflicting Interests
The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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