Society for American Sign Language Journal

Volume 7
Number 1 *What to Learn from Undergraduate Research in ASL/Deaf Studies*

Article 6

April 2024

Afterword: Advancing Knowledge Through the Richness of Undergraduate Research

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Students inspire us. They offer faculty new views upon which to examine and understand the world and each other's experiences. As students pursue higher education, they often confront unknown realities, consider new ways of thinking, and work to define who they are as they pursue careers and build knowledge for their own critical analysis and understanding.

Just as children grow through developmental stages, students also develop and grow in their knowledge and disciplinary thinking. During one's toddler years, children are often curious and ask the question "Why?" about almost everything. The "why stage" is one way toddlers explore their world and understand their everyday realities. As we mature, we adopt more "normative" culturally driven behavior as well as unconscious biases. Children begin to understand the world through the words and experiences of others.

This developmental process also occurs in higher education. Students arrive not fully conversant in their chosen discipline; in fact, many students take general education and liberal arts courses that expand their world view. When students enter this world, they are at a "younger" developmental stage and lack the cultural norms, biases and lenses of their expert faculty. This allows them to often ask questions at a more novice, and perhaps, more novel level; these questions are the "why?" questions of toddlerhood. For faculty, students' questions can inspire and be refreshing. Novice and novel perspectives provide faculty with the need to re-imagine, reconsider and even reframe their own thinking about their discipline, their world views, the questions they ask, and the research they pursue. Having students explore and ask questions without the disciplinary lenses firmly embedded in their thinking creates an environment rich with wonder. This foundation of wonder creates a rich atmosphere upon which to pursue undergraduate research.

Author Statement & Bias regarding Undergraduate Research

In qualitative inquiry, researchers are required to make known their past experiences and biases that could influence their methods, analyses and findings. In order to share more fully my analysis regarding undergraduate research, I am setting forth my background and the lens through which I have experienced undergraduate research.

My own passion for undergraduate research began during my undergraduate career as I was able to ask questions and complete a survey about nurses' attitudes regarding organ donation, which was becoming an increasingly common practice and specialty area of nursing. It was then fueled during my own graduate studies as I learned multiple ways of asking questions based on current and classic literature, and in doing so, I learned of the many research philosophies and methods that could be used to answer the questions I had about the world and my discipline of nursing.

As a young faculty member, I was thrilled with my students' research interests and questions, and I was able to help hone their focus. Not all students were excited by research pursuits or learning methods for inquiry. This attitude challenged my thinking as my focus was to improve quality of life and healthcare, and I believed research evidence would define the strategies needed to support patients and families. With research funding, I was able to support students' participation at regional research conferences. Upon return, one of my students shared her excitement saying "I never knew that side of nursing existed." This statement cast my future in supporting students as they pursued their education. For to influence the future and build a legacy of best practices for quality care and health outcomes, evidence-based, research-informed practice is essential.

With this background from my education and then faculty experience, I have spent my career investing in undergraduate research support for students. For it is my philosophy that learning through doing can propel one's passion and support students' academic success and future career success. Ultimately this type of learning experience improves the world within which we live.

Undergraduate Research as a High Impact Practice

Undergraduate research has become an increasingly common opportunity for students as they encounter new knowledge. As defined by the Council on Undergraduate Research, it is "a mentored investigation or creative inquiry conducted by undergraduates that seeks to make a scholarly or artistic contribution to knowledge" (Council on Undergraduate Research, 2024). Undergraduate research takes place across all disciplines to include their forms and methods of scholarship activity, whether through traditional scientific methods, historical analyses or creative inquiry.

Numerous resources, publications and lessons learned are available to guide faculty as they consider their own interests in supporting undergraduate students through this mentored experience. The Council on Undergraduate Research was founded in 1978 and reports having a membership of more than 13,000 and almost 700 institutional members. This community offers annual conferences and opportunities for faculty to define their own best practices and pedagogical strategies for supporting students and provides a forum for students to present their research and engage with peers from across the country.

Undergraduate research is identified as one of eleven recognized "high-impact" practices, which have "significant educational benefits for students who participate in them – including and especially those from demographic groups historically underserved by higher education" (American Associate of Colleges & Universities, 2024). Undergraduate research supports and requires extended faculty-student collaborations and connections beyond the classroom, which lead to student engagement in one's own learning. The literature examining undergraduate research as a high-impact educational strategy for student success is filled with reports on its effectiveness. Kilgo et al. (2015) reported long-term outcomes for high-impact practices; they found strong positive correlations between undergraduate research and the outcomes of critical thinking, need for cognition, intercultural effectiveness and positive attitude for literacy. Subsequent research demonstrates similar positive outcomes from student participation in undergraduate research. The literature fully supports undergraduate research as a strategy for student engagement, retention and academic success.

Styles & Formats for Undergraduate Research

Traditionally, undergraduate research is often offered as a 1:1 faculty-to-student experience, one student working directly with their professor. For students who work in faculty members' labs and serve as research assistants, their experience is framed by answering the questions faculty ask; students provide their time in learning research methods and instrumentation, collecting data, managing files, documenting findings,

and thus contributing to already defined research questions and planned studies. This type of faculty-mentored experience remains popular. Students may be hired into the faculty lab, use the experience as an independent study and gain university credit for their learning, or may volunteer their time and effort simply to gain experience as they explore the discipline and prepare for future graduate education. [Please note: A faculty "lab" may be a physical laboratory or any place in which a scientific inquiry may be pursued.]

Another traditional 1:1 format for undergraduate research occurs when students have their own research questions and seek faculty guidance and mentoring to plan and pursue answering their questions. These types of experiences are also faculty mentored, but the research question originates with the student. Students may pursue their research through funded competitions, work in faculty labs and receive college credit for their work. Faculty guidance and sponsorship is an important characteristic with these individually focused inquiries.

Undergraduate research can also be offered through group-based opportunities. Faculty may offer and sometimes fund multiple students in their studies or labs, often teaching a team of students who participate in supporting the faculty member's research. In research intensive universities with significant funded resources and extensive laboratories, these teams of students may include both graduate and undergraduate students, often with graduate students overseeing undergraduates' activities. An efficiency occurs in these collaborations as multiple students benefit from working collaboratively with faculty; faculty researchers teach and mentor students concurrently; and students support a succession plan for research support across years.

A growing group-based format for undergraduate research is "course based undergraduate research experiences" (CUREs). As noted by its name, the undergraduate experience is offered to all students and participation is a course requirement. Study questions may be assigned to students working in small groups and course time can include any aspect of the research journey, from in-depth analysis of the literature through data collection, analysis and reporting findings. Study questions may also be developed by students, working in groups or individually. An important feature and strategy is ensuring students can complete the assigned work in the course of a single semester. CUREs offer an efficient method of offering undergraduate experiences to many students, not just a few select students.

Whether working with one's faculty individually or in a group, the undergraduate research experience provides opportunities for students to collaborate with faculty and explore the world. Students gain experiences in asking questions, critically thinking about the current state of evidence and seeking additional evidence and support that furthers disciplinary knowledge. Faculty also benefit in working with undergraduate students as they pursue their research. As noted previously, the hands-on support may extend the professor's ability to complete their research, perhaps through additional analysis and monitoring of the literature, data collection, instrumentation and documentation. In sharing their passion, interests and disciplinary inquiry, faculty build a legacy of inquiry across future generations of students, thus extending the development of knowledge in their discipline.

Not noted previously in this paper, undergraduate research takes faculty time and effort in educating students and mentoring them forward in research procedures. Students may need more time to complete data collection as they first need to be oriented to and learn techniques. For each new student, faculty must make a commitment of their own time and effort, which could slow the outcomes of one's research. Faculty work-life balance and the ability to be productive with one's research become important considerations. Not all faculty choose to support undergraduate students in this way.

Similarly, students may hesitate to pursue undergraduate research, especially if it takes time outside the classroom. Students who have the need to support families and balance other life needs may be unable to participate in traditional undergraduate research opportunities. Further, some students may not have a level of comfort in approaching faculty, gaining entrée to faculty research or even being aware that such opportunities exist. For these students, CUREs offer an important and potentially more inclusive opportunity to participate in undergraduate research (Bangera & Brownell, 2014).

Case Analysis

The papers presented in this issue of SASLJ are rich examples of undergraduate research. The individually authored papers demonstrate examples of foundational knowledge as building blocks to future research. LaVigne's paper on hereditary deafness is a critical analysis needed before furthering research in this area. To ask questions responsibly, one must first understand the current state of the science. LaVigne contributes to the literature and the reader's knowledge and offers commentary related to social change and ethical awareness, both important aspects for responsible and effective research inquiry.

In a like manner, Meija-Tejada provides a descriptive report of the lived experience of deaf scientists in STEM, noting their contributions and strategies for accessing STEM related careers of distinction. In reporting the unique and shared experiences, the reader gains access to an unknown world. This knowledge again is foundational for future inquiry into the lives of deaf scientists in STEM and promotes strategies for action to build inclusive environments for full participation by hearing and deaf collaborative teams of scientists. Especially fascinating is Meija-Tejada's discussion of ASL communication as a common language across cultures with different languages and exploring this as effective social change.

Using a different model of research inquiry and undergraduate research, Turell, Cripps and Dillard report on their study, which required human subject consent and participation and analysis of survey data. Using community-based participatory research, Turell, et al. developed and pilot tested webinars as a means for teaching ASL to community participants. This manuscript provides the very traditional sections of a research report with review of literature, methods, analysis and discussion of results. The researchers address their interest in social change and selected methods that support their interest in and understanding of how to bring ASL into the larger hearing community. The methods employed were selected to provide the framework needed for establishing community change. Their findings support future research directions for building a more inclusive community in which all can communicate together.

Another rich aspect of these papers and as discussed by Dr. Cripps in the Editor's Note is that the students and faculty who participated were diverse; some were hearing and some were not. The communication experiences differed; how one interacts with the world differed. What was common was the passion and interest in pursuing inquiry about inclusive communities and social change to influence and improve the world within which we live.

Closing Remarks

Undergraduate research is a catalyst, helping students move their education and careers forward as faculty guide, support, further explore and expand the reach of their own work. The papers published in this issue share a theme of social change and provide readers with a useful scaffold and framework that may be further developed and used to extend current knowledge and practices. In addition, the research informs future inquiry and serves as a catalyst to building more inclusive communities.

Students actively mentored through undergraduate research extend and build the legacy of their faculty. When faculty choose to support undergraduate research, they pave the way for ongoing development of their science. Elizabeth Barrett Browning wrote a poem titled "Light tomorrow with today." These words are most fitting of faculty investment in students, for indeed, undergraduate research is a rich resource that helps illuminate our world.

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