Introduction to the Special Issue on Perspectives and Experiences on Mentoring Undergraduate Students in Research: Part II

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Introduction to the Special Issue on Perspectives and Experiences on Mentoring Undergraduate Students in Research: Part II

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Abstract: This issue is the second of a special PRIMUS two-part issue collecting articles on undergraduate research from experienced faculty mentors. We offer it as a valuable resource for faculty leading undergraduate research programs. This issue presents a collection of papers offering advice on a variety of specific topics important for leaders of undergraduate research programs. Issues of finding and designing appropriate and accessible research projects, assessing undergraduate research, and publicizing it in the media are addressed.

Keywords: Undergraduate research, REU, mentoring, mathematics

This issue is the second of a PRIMUS special two-part issue on Undergraduate Research. The papers in this issue, many originally presented as part of the MAA Contributed Paper Session Perspectives and Experiences on Mentoring Undergraduate Students in Research at the 2015 Joint Mathematics Meetings, guides readers through various stages of research with students. In the editorial for Part I, we discussed the enormous growth of undergraduate research in mathematics over the past three decades. The papers in Part I were primarily focused on the details of creating, running, and sustaining an undergraduate research program in mathematics.

In this issue, we focus on specific advice for leading an undergraduate research program. In particular, we address the most challenging question: How to find suitable, accessible research problems that will result in successful learning outcomes for the undergraduate student? As professional mathematicians, we are used to spending days, weeks, months, and even years, before our research efforts are rewarded with a new mathematical result. Although one benefit of undergraduate research...
research is teaching students the value of perseverance, it is important to find problems that increase the odds for a successful research outcome.

The papers in this issue present a number of perspectives on finding research problems that work well for undergraduates. It is our hope that these papers will inspire others to find their own problems for their students. Other papers describe techniques such as journaling or media exposure that can enhance the overall research experience. As with the papers in Part I, we view these papers as an addition to the existing literature [4], [7], [9], [3, 2, 7], [6], [1], [8].

The first two papers propose innovative ways to increase the number of undergraduate research opportunities by lowering the investment costs for faculty. **CRP: Collaborative Research Project (A Mathematics Research Experience for Undergraduates)** describes a nationwide collaborative undergraduate research experience, modeled on the Polymath Project, with low per-student organization costs. This project was able to involve 100 undergraduates in a one-month project. The paper **An Introductory Research Experience in Mathematics for Undergraduates** describes how a short eight-day intensive summer program can excite students about mathematics and give them a meaningful “entry point” to mathematical research.

This issue presents five papers describing successful faculty experiences in choosing applied and computational research problems for undergraduates. **An Applied Project-Driven Approach to Undergraduate Research Experiences** outlines one mentor’s experiences, details the processes he has developed, and provides a perspective for establishing undergraduate research programs in applied mathematics. The paper **Leading Undergraduate Research Projects in Mathematical Modeling** gives a systematic approach for creating research problems that address real-world problems using mathematical models derived from calculus.

In **SAGE as a Source for Undergraduate Research Projects**, the benefits of students using a computer algebra system, in particular the open-source system SAGE, to apply theoretical knowledge to specific computational problems are described. The author details a tiered working group model that incorporates many students while maintaining a reasonable time commitment from the faculty mentor. The difficulty of continually finding good research projects is the subject of **Undergraduate Research in Quantum Information Science**. In this article, the author documents his success in finding many successful projects in an interdisciplinary field combining mathematics, computer science, and physics. Lastly, in **Year-long Undergraduate Research Projects**, an alternative to the usual model of group projects is presented. The author details his success with open-ended year-long undergraduate research projects and provides advice of the characteristics of projects that are likely to be successful.

The student side of the research experience is presented in **Mentoring Student Participation in Undergraduate Research: A Case Study of Twists and Turns from Two Perspectives**. It offers a case study that examines the challenges and successes of this research project from the perspectives of a first-generation college student and his advisor.
Finally, this issue contains two articles focusing on the use of assessment and the larger community to motivate students in their research. Assessing undergraduate research can be challenging due to the vagaries of research. The paper *Assessing Aspects of Undergraduate Research Through Journaling* shows how journaling can be beneficially used throughout the research experience to provide a means of assessment. Additionally, it increases student motivation to write up their research results. *Media Exposure on Student Work: Spotlight on Undergraduate Research* concludes the issue with highlights how to use media engagement both to motivate students and to educate the general public about the beauty and importance of mathematics.

As noted in the first issue’s editorial, the 2015 MAA Curriculum Guide [4] calls for every mathematics major to be provided an opportunity to tackle a “substantial mathematical project” involving concepts beyond a single course. Undergraduate research provides a wonderful opportunity for these projects. We hope faculty will be inspired by the successful research projects in applied, computational, and pure mathematics presented in this issue, and by the essays on assessment and the use of media, to enhance their own undergraduate research programs.

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**REFERENCES**


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