

Contents

Teach Them to Fish	vii
Foreword	xi
About this book	xiii
Acknowledgments	xvii
1 Why should undergraduates do research?	1
1.1 Introduction	1
1.2 Benefits to students	2
1.3 Benefits to faculty	3
1.4 A brief history of undergraduate research in mathematics	6
1.5 Getting started	8
2 A beginner's guide to mentoring undergraduates in research	11
2.1 The six fundamental steps	11
2.2 Step 1: Picking an appropriate research problem	13
2.3 Step 2: Recruiting and selecting students to mentor	15
2.4 Step 3: Setting expectations and dealing with group dynamics	17
2.5 Step 4: Starting the research and moving it forward	18
2.6 Step 5: Helping students develop communication skills	21
2.7 Step 6: Preparing for the future	22
3 Choosing appropriate research problems	25
3.1 Six characteristics of good undergraduate research problems	25
3.2 Branching out	38
3.3 Conclusion	40
4 Choosing students and managing group dynamics	43
4.1 Where can I find students to work with on research?	43
4.2 How can I choose research students from a bigger pool of potential researchers?	46
4.3 Discussing expectations and group dynamics	47
4.4 Working with students from underrepresented minority groups	49
4.5 Individual and group dynamic scenarios	53

5	Helping students communicate their results	61
5.1	Common elements in mathematical communication	62
5.2	Writing a paper	63
5.3	Giving a talk	70
5.4	Presenting a poster	77
5.5	Non-traditional forms of communication	82
5.6	Conclusion	83
6	How to write a successful grant proposal and get funding for undergraduate research	85
6.1	Having a great idea	86
6.2	Building a track record	88
6.3	Finding sources for funding	91
6.4	Matching your idea with an appropriate funding opportunity	97
6.5	Writing a clear and persuasive proposal	98
6.6	Writing a budget	103
6.7	Submitting your proposal	104
6.8	Aftermath	105
7	Summer REU Programs	107
7.1	What is an REU?	107
7.2	Components of a successful REU	109
7.3	Pre-REUs, RETs, and more	122
7.4	Are you ready? Jump in!	123
8	Assessment of undergraduate research programs	125
8.1	Assessment design and learning outcomes	125
8.2	Linking learning outcomes to assessment practices	128
8.3	Limitations of assessment practices	134
8.4	The impact of undergraduate research in mathematics and beyond	135
9	The future of undergraduate research: Enhancing curricula, building partnerships, launching careers	137
9.1	The Council on Undergraduate Research (CUR)	137
9.2	Integrating and building undergraduate research into curriculum and coursework	141
9.3	Careers for mathematics majors and innovation and collaboration in undergraduate research	146
9.4	Internationalization and undergraduate research	155
9.5	Other future directions	160
9.6	Conclusion	164
A	Sample Grant Proposals	165
B	Acronyms	199
	Bibliography	203