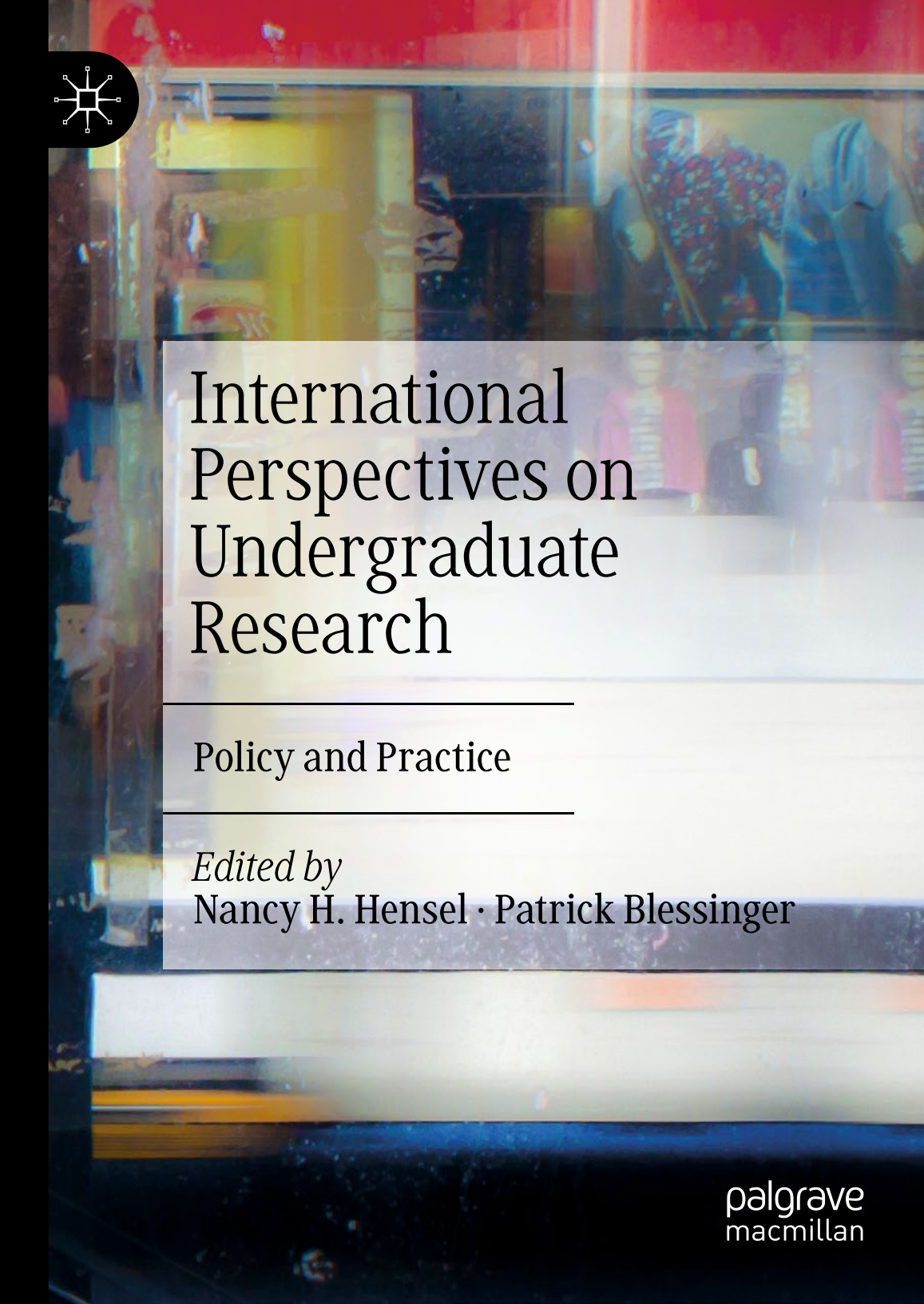

International Perspectives on Undergraduate Research

Policy and Practice

Edited by
Nancy H. Hensel · Patrick Blessinger

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Foreword to International Undergraduate Research

From the United States to the United Arab Emirates, undergraduate research (UGR) is capturing and maintaining the focused attention of university faculty, administrators and especially of students. *International Undergraduate Research* demonstrates why. The thinking required by, and developed through, UGR is valuable not only to those within the university, but increasingly to employers and politicians who want graduates with the capacity to solve issues of current concern to society, entrepreneurs who craft whole new ways of working in the world.

There are common challenges across the book's chapters of inadequate university budgets and lack of country-wide mandate, but the diversity of approaches to deal with these and other issues is a big illuminating feature of the book. For example, numerous chapters view UGR in terms of its capacity to build disciplinary knowledge and Makhanya emphasises the need for UGR knowledge development to align to national socio-economic challenges and priorities. Elshimi, however, provides a contrast of emphasis for Egyptian UGR, shifting from the more common focus on building the discipline to solving the problems of pressing community and environmental issues. In all chapters, however, UGR is seen to result in substantial, sometimes life-changing, skills and attitudes of research that students develop and apply broadly and deeply on graduation.

Blessinger and Hensel note that UGR has been declared a high-impact practice, yet the nature of the impact depends on how effectively UGR is implemented. Sengupta and Blessinger consider UGR in India, Malaysia and Iraq and note that determining the impact of UGR remains a

challenge in most countries. However, knowing the nature of, and limitations to, UGR impact is vital to work on context-sensitive ways of improving it, whether through tweaking, adaptation or implementation of new models. There is the possibility of negative impact through bad experiences, such as under-equipped mentors, poor scaffolding of skills needed for research projects in the curriculum or even culturally unaware implementations.

Because of the risk of sub-optimal UGR, various chapters deal with mechanisms for improving the teaching/supervision aspects of UGR. Makhanya provides understanding about professional development and Donnelly, McAvinia and McDonnell focus on peer learning. The formation of UGR societies, following on from the Council on Undergraduate research in the USA, has emerged in regions such as Australasia (Brew and Mantai), but such formation is noted as lacking in the majority of chapters. Readership groups, such as university clusters in one country, will be interested to read factors that have led to the development of UGR societies and factors that have been inhibitive of them. However, the role of such societies on the upskilling of faculty and the long-term impact on student learning is in need of research attention.

While some countries have focused on the model of mentored UGR that relies on faculty research agendas, others are more invested with in-curricular models, and still more countries entertain blended or multiple models. However, there are challenges with evaluating the impact of different models of UGR, and Wuetherick considers the state of play in Canada of mentored and curriculum-embedded models. Mentored models have the challenge of accounting for UGR outcomes not just compared to other models of learning, but with reference to increased resourcing and its direct or indirect costs. A major issue, then, for global UGR, is the sustainability of mentored models when compared to in-curricula models. Hybrid models that, for example, use students with experience of UGR to mentor less experienced students also need to be researched.

Issues of equity, including of who gains access to UGR and who is able to persist, and benefit are vital for determining impact. This is particularly important in mentored UGR, which has limits to involvement and, typically, selection criteria for inclusion. Chng Huang Hoon and Siew Mei focus on the more inclusive model of UGR embedded in the curriculum in Singapore, which provides opportunities for all. However, this model too has challenges for evaluation. The curriculum space occupied by UGR

has its own costs, for example in terms of reduced content coverage, and evaluation of impact must take into consideration controversies of content-covering versus skills-based curriculum.

There is a variety of experiences in the book in terms of how long since UGR was first promoted explicitly in the country of focus, with the USA (Ambos) witnessing an evolving clear mandate over more than four decades that has included engagement with, and funding from, the nation's Congress. Ironically, Germany (Deicke and Mieg), the homeland of the Humboldtian model of research universities, has not had undergraduate enrolment until recent times, so the chapter provides insights for a system just starting to promote UGR, as does the chapter on Japanese UGR (Imafuku). New Zealand (Spronken-Smith) has national legislation that calls for close links between teaching and research, yet its university system nevertheless provides patchy opportunities for UGR.

Taken together, the book does not imply one superior model for UGR, but rather the need for creative and thoughtful implementations that are context-savvy and that embrace a willingness to improve and improvise.

As this book is readied for publication in the dark days of the COVID-19 crisis, I commend the ambition and dedication that the authors convey for the development of graduates who will light the way through their contribution to solving each country's and our global problems using the skills and attitudes that they learn in UGR.

Adelaide, Australia
14 April 2020

John Willison

Preface

Undergraduate research is becoming part of the student research experience for students in many countries. Undergraduate research is not a new pedagogy. Its history is often/widely attributed to the work of Wilhelm von Humboldt, who founded the University of Berlin in 1810. Humboldt stressed an educational approach that unified teaching, learning, and research, and the continuing process of inquiry. American universities, as with most universities around the world today, grew out of the German model. For instance, in the United States, the Massachusetts Institute of Technology (MIT) began formally involving undergraduate students in research in 1969. After Professor Margaret MacVicar founded the Undergraduate Research Opportunity Program at MIT, many other US institutions began similar programs over the next few years.

The Council on Undergraduate Research was founded in the United States in 1978 to assist colleges and universities in developing undergraduate research programs and advocating for federal funding to establish undergraduate research programs. While there are common roots for the concept of undergraduate research, there is no consensus within the international community of scholars on its parameters. It is the differences in emphasis, program implementation, funding, and policies that make the study of undergraduate research across the globe both an exciting topic and a resource for future program development and implementation. While approaches to student research vary, there is however common agreement that undergraduate research positively impacts student learning and contributes to career preparation.

The purpose of this book is to explore the implementation of research-based teaching and learning in countries around the world. International collaboration in high-impact, experiential learning is a significant interest of both editors. Patrick Blessinger founded HETL (International Higher Education Teaching and Learning Association) to advance the scholarship and practice of teaching and learning around the world. He has brought together international scholars to engage in cutting-edge research to develop innovative practices in global higher education, including high-impact areas such as inquiry-based learning, education for sustainable development and social responsibility, university partnerships, equity, inclusion, and leadership. Under his leadership, HETL has grown into one of the largest and most active research networks of educators around the world. While Nancy H. Hensel was the executive director of the Council on Undergraduate Research (CUR), she invited practitioners and scholars of undergraduate research from many countries to contribute to the CUR Quarterly and participate in CUR activities. During her leadership, CUR began several international collaborations.

Blessinger and Hensel identified leading educators from 15 countries to contribute to this book. As they identified potential authors, they wanted a range of perspectives on undergraduate research. They also wanted to include countries from every continent (except Antarctica). They approached scholars whom they knew to be involved in undergraduate research and were leaders in their field. They asked them to consider how student research is defined in their country, organizations that might support student research, national policies and initiatives for student research, and curricular models for implementing undergraduate research.

Chapter Summaries

In Chap. 1 Patrick Blessinger and Nancy H. Hensel discuss how the demand for global higher education of all types has increased significantly over the past few decades and how this has prompted educational leaders to enlarge and improve their educational offerings by developing a more learner- and learning-centered approach to education in order to increase student engagement. An increasing number of educational institutions around the world have implemented undergraduate research because it has been shown to be a high-impact learning activity for students, if designed

and implemented properly. This chapter discusses the common elements of successful undergraduate research programs and the common factors that should be considered when designing and implementing such programs. Based on the research from the chapters in this book, the authors propose a generalized undergraduate research model that can be used in a variety of contexts across institutions and grade levels and disciplines.

In Chap. 2 Elizabeth L. Ambos discusses how undergraduate research in the United States has grown in concert with the development of the Council on Undergraduate Research (CUR).

The author discusses the history of CUR and its role as a leader in promoting CUR around the world as well its plan to diversify and expand its role in the future.

In Chap. 3 Angela Brew and Lilia Mantai discuss the development of undergraduate research in Australia over the past decade. The authors explain the challenges in developing a culture of undergraduate research in higher education institutions in Australasia. For instance, they explain that creating the Australasian Conferences of Undergraduate Research was important in establishing undergraduate research in Australasia and how the use of seminars and workshops helped raise awareness of undergraduate research across Australasia and how these efforts led to the establishment of the Australasian Council for Undergraduate Research as a membership organization.

In Chap. 4 Chng Huang Hoon and Wu Siew Mei define undergraduate research as a student-centered inquiry that makes an original academic or creative contribution to a discipline. In this chapter, the authors discuss undergraduate research within the context of National University of Singapore across the disciplines of engineering, science, computing, and arts and social sciences. The authors argue that it is possible to create symbiotic connections between university research and student education by integrating undergraduate research and learning into the curriculum and across disciplines.

In Chap. 5 Amani Elshimi discusses undergraduate research practices at different universities in an attempt to identify an overarching strategy and guiding vision. The author explains that most Egyptian universities focus undergraduate research on problem-solving for environmental and community issues where the student learning experience is shaped within the context

of economic development. The author uses the American University in Cairo as a case study and examines the goals, infrastructure, funding, staffing, and outreach of the program. The author highlights the area of university partnerships as well as the alignment of objectives of different units across campus as key factors for undergraduate research success.

In Chap. 6 Rintaro Imafuku provides an introduction to undergraduate research in Japan and discusses the future of undergraduate research in Japan. The author discusses how Japanese higher education institutions have emphasized final- year projects but have increasingly adopted undergraduate research across disciplines as an effective pedagogical approach. The author discusses the challenges associated with implementing undergraduate research such as the absence of a supporting organization. The author recommends developing a community of practice that will allow professors to share their experiences and best practices.

In Chap. 7 Enakshi Sengupta and Patrick Blessinger discuss the benefits and challenges of undergraduate research as presented in the academic literature. The time needed to implement undergraduate research is significant. The authors focus on undergraduate research in India, Malaysia, and the Kurdistan region of Iraq. They discuss the results of survey of faculty members teaching undergraduate students and the faculty experiences are discussed. The findings of the survey suggest that undergraduate research programs in these countries have been limited as a result of financial constraints and lack of support staff.

In Chap. 8 Ana Lucia Manrique and Douglas da Silva Tinti discuss how Brazil has implemented scientific initiation research programs to support undergraduate research. The authors discuss the results of a survey on the implementation of undergraduate research related to the faculty supervisor's projects and lines of research.

In Chap. 9 Roisin Donnelly, Claire McAvinia, and Claire McDonnell discuss the impact of faculty and student learning related to sharing inspirational practices and creating multimedia at a university in Ireland. The authors discuss the increasing demand for professional

development, the importance of a peer learning, the development of multimedia artifacts for undergraduate supervision, and the national context for this type of work.

In Chap. 10 Mandla S. Makhanya discusses three areas for integrated research development: niche research themes aligned to national socio-economic priorities, targeted development of inter- and transdisciplinary research, and of higher education institutions. Makhanya discusses the preparation of researchers who will help level the global research playing field and contribute to national development.

In Chap. 11 Isabelle Mirbel and Margarida Romero discuss how a national research ecosystem has been developed to promote excellence in academic research. The authors note that a research-oriented curriculum at the undergraduate level has yet to be considered at a national policy level. The authors also note that, in spite of this, various initiatives exist within higher education institutions to encourage the participation of undergraduate research activities. The authors discuss current initiatives for engaging undergraduate students in research projects, especially those research activities that develop the research competencies that allow undergraduate students to engage in research after graduation.

In Chap. 12 Wolfgang Deicke and Harald A. Mieg discuss how the *Bologna* Reform process and the introduction of a two-cycle BA/MA degree system impacted the German higher education system. The authors highlight how policy initiatives such as the Quality Pact for Teaching (QPT) facilitated new approaches to research-based teaching and learning in German higher education since 2012.

In Chap. 13 Jase Moussa-Inaty discusses how the global trend of students engaging in undergraduate research holds true in the United Arab Emirates (UAE) as well. The author discusses how undergraduate research in the UAE is recognized as an important part of student learning and engagement. The author discusses some of the most recent attempts made to encourage undergraduate research.

In Chap. 14 Rachel Spronken-Smith discusses recent legislation that calls for a close link between research and teaching at New Zealand universities and how this new legislation has put a renewed focus on creating more and higher-quality undergraduate research programs. Yet, the author notes that opportunities for undergraduate students to engage in research

are limited. The author also notes that only a fraction of undergraduate programs scaffold the development of research skills throughout the curriculum toward a culminating capstone project. As a result, notes the author, although undergraduate research is pervasive across New Zealand universities, it is not always well supported.

In Chap. 15 Brad Wuetherick discusses how undergraduate research has a strong tradition across Canadian higher education institutions. The author notes that institutions are still challenged to ensure that all undergraduate students are engaged in high-impact research over the course of their university experience. Thus, the author explores the state of both mentored (co-curricular) and curriculum-embedded undergraduate research experiences at universities across Canada.

In Chap. 16 Luísa Soares discusses the undergraduate research experience in Portugal. The author explores whether or not undergraduate students are cognitively and emotionally mature enough to carry out high-quality, scientifically rigorous research. The author argues that it is possible for undergraduate students to carry out rigorous undergraduate research but it must be accompanied with a solid foundation in ethical research principles.

Conclusion

The research findings and case studies presented in this book provide an important knowledge base for those educational professionals thinking about designing, developing, and implementing undergraduate research at their own institution as well as those interested in improving an already existing undergraduate research program. This book not only provides an overview of undergraduate research—its purpose and principles—but it also provides an overview of the current undergraduate research landscape by examining authentic programs and experiences across a diverse set of higher education institutions around the world. As such, for those interested in implementing undergraduate research, this book offers a meaningful guide to that end.

Laguna Woods, CA, USA — Nancy H. Hensel
New York, NY, USA — Patrick Blessinger

Contents

Notes on Contributors

Elizabeth L. Ambos served as the Council on Undergraduate Research's fourth executive officer from 2012 to 2019. From 2006 to 2012, Ambos was assistant vice chancellor for research initiatives and partnerships for the California State University system. Prior to that, she held positions at California State University, Long Beach, including Associate Vice President for research, Graduate Dean, Associate Dean in sciences, and Geology Professor. Ambos received her AB in Geology from Smith College and her MS and PhD from the University of Hawai'i at Mānoa in Marine Geology and Geophysics.

Patrick Blessinger is an adjunct associate professor of education at St. John's University, an educator with the New York State Education Department, and chief research scientist of the International Higher Education Teaching and Learning Association (in consultative status with the United Nations). Blessinger is an educational policy analyst and contributing writer with UNESCO's Inclusive Policy Lab, *University World News*, *The Hechinger Report*, *The Guardian*, and *Higher Education Tomorrow*, among others. Blessinger teaches courses in education, leadership, and research methods and serves on doctoral dissertation committees. Blessinger founded and leads a global network of educators focused on improving teaching and learning and is an expert in inclusion, equity, leadership, policy, democracy, rights, and sustainability. He has received several educational awards, including: Fulbright Senior Scholar to Denmark (Department of State, USA), Governor's Teaching

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Angela Brew is Emeritus Professor and previously Professorial Fellow in the Learning and Teaching Centre at Macquarie University, Australia. She is an elected Fellow of the UK's Society for Research into Higher Education (SRHE), a Life Member of the Higher Education Research and Development Society of Australasia (HERDSA), and an Australian Senior National Teaching Fellow.

Chng Huang Hoon is Associate Professor of English Language & Literature and serves concurrently as Associate Provost (Undergraduate Education) and Director (Chua Thian Poh Centre for Community Leadership) at the National University of Singapore. She is a member of the International Society for the Scholarship of Teaching and Learning (ISSOTL) and currently serves on the ISSOTL Board of Directors as co-President Elect and was formerly ISSOTL's Regional Vice President (Asia Pacific). She is active in promoting SoTL, particularly through the regional network called SoTL-Asia, which she established with her NUS colleagues in 2016.

Douglas da Silva Tinti graduated in Mathematics (2006) and Postgraduate Studies in Applied Statistics (2008) from the Methodist University of São Paulo. He holds a master's (2012) and a PhD (2016) in Mathematics Education from the Pontifical Catholic University of São Paulo (PUC-SP). He is Professor, Department of Mathematics Education of the Federal University of Ouro Preto, Minas Gerais, Brazil. His research interests lie in teacher education and mathematics education.

Wolfgang Deicke read Sociology and Politics at Hamburg University and later at the Postgraduate School of Peace Studies in Bradford. Before becoming the coordinator of the bologna.lab at Humboldt-Universität zu Berlin in 2012, he variedly taught Sociology, Politics and the History of European Thought and Society at the (now) University of Northampton, School of Oriental and African Studies in London and Ruskin College, Oxford. In Northampton and Oxford, he gained comprehensive experience in course and curriculum development and the development of curricula for active learning. His current

research interests are the development of (student) research competencies and organizational development in higher education.

Roisin Donnelly is Head of Learning Development for the College of Business in the new TU Dublin. This role sees her supporting the College in achieving impact and excellence in teaching and learning through partnership and program provision, promoting enhanced [e]learning strategies and Business Education communities of practice. This builds on her previous positions as Lecturer, Program Chair/Coordinator, Academic Developer for 18 years and as sectoral Project Manager for the initial national implementation of the Professional Development Framework for teachers in Irish higher education. She is a member of the national Professional Development (PD) Advisory Group established to shape how the National Forum for the Enhancement of Teaching and Learning achieves sectoral strategic objectives in relation to PD. She is a fellow of the UK Staff and Educational Development Association (FSEDA), a fellow of the Higher Education Academy (FHEA), and coeditor of the *Irish Journal of Academic Practice*.

Amani Elshimi is Senior Instructor of Rhetoric and Composition, and Founding Director of the Office of Undergraduate Research at the American University in Cairo. She is a devoted advocate of undergraduate student scholarship, and an active practitioner of engaging pedagogies, including community-based learning, senior capstone experiences, and course-based internships. She has over 25 years of experience in higher education teaching, faculty development, curriculum design, assessment, and program administration.

Nancy H. Hensel was the first president of The New American Colleges and Universities, serving from 2004 until 2011. Previously, she served as chief executive officer of the Council on Undergraduate Research in Washington, D.C. for seven years. During her tenure at CUR, she was co-principal investigator for seven National Science Foundation grants to assist faculty and institutions develop undergraduate research programs. She initiated an undergraduate research program at the University of Maine at Presque Isle where she served as president. Prior to her presidency, she was provost at the University of Maine Farmington and professor of education and department chair at the University of Redlands.

Hensel holds a doctorate degree in early childhood education from the University of Georgia, masters' degrees in theater and early childhood education from San Francisco State University and a Bachelor of Arts in theater also from San Francisco State. In 2003, Hensel was inducted into the Maine Women's Hall of Fame for her work in promoting higher education in Maine and supporting the role of women in higher education. She is the author of *Course-Based Undergraduate Research: Educational Equity and High Impact Practice* and several articles and monographs about undergraduate research.

Rintaro Imafuku is an assistant professor of Medical Education Development Center at Gifu University, Japan. He holds an MA (Applied Linguistics) from Monash University and PhD (Education) from the University of Hong Kong. His work focuses on interactional and ethnographic exploring of students' learning in learner-centered inquiry-based educational environments, including PBL, undergraduate research and interprofessional education. He is editing a volume on *Interactional Research into Problem-based Learning* (with Susan Bridges, Purdue University Press) and has guest-edited *Interdisciplinary Journal of Problem-Based Learning*. He is also an editorial board member of several journals, including *BMC Medical Education*.

Mandla S. Makhanya was appointed Principal and Vice Chancellor of the University of South Africa on January 1, 2011 and is a prominent proponent of higher education leadership and advocacy. Makhanya is past President of the International Council for Distance Education (ICDE), Treasurer of the African Council for Distance Education (ACDE), and President of the Higher Education Teaching and Learning Association. Makhanya is a Deputy Chairperson of the South Africa National Commission for UNESCO. He has also been a member of the National Committee of the Memory of the World (MoW). In the 1990s, he served in various leadership roles in the South African Sociological Association, including as Deputy President I 1998, for International Association of Sociology (ISA). Makhanya is on the advisory board of JRODel (*Journal of Research in Open, Distance and e-Learning*).

Ana Lucia Manrique graduated in mathematics, University of São Paulo, Brazil (1987). She holds a master's degree in Mathematics (1994) and a PhD in Education (2003), Pontifical Catholic University of São Paulo (PUC-SP). Manrique obtained a postdoctorate in Education, Pontifical Catholic University of Rio de Janeiro (2008). She is Professor on the Mathematics Education Program, PUC-SP, Brazil and Productivity Researcher at CNPq (PQ2). She has coordinated projects financed by Brazilian development agencies (Capes, CNPq, and Fapesp). Her research interests lie in inclusive education, teacher education, and mathematics education.

Lilia Mantai is Academic Lead, Course Enhancement at The University of Sydney Business School. She was awarded a PhD for research on researcher development of doctoral students in 2017 at Macquarie University. She is a senior fellow of the Advance HE/Higher Education Academy.

Claire McAvinia is an academic developer at the Learning, Teaching and Technology Centre (LTTC) in TU Dublin. She is currently LTTC Programs Chair and lectures on the Centre's accredited postgraduate programs and modules in learning and teaching, and e-learning. Her interests are in academic development, digital literacies, curriculum design, and open education. Claire is engaged in supervision of students in master and doctoral programs. She has published on a range of topics in e-learning and academic development, and in 2016 completed a book based on her doctoral research, *Online Learning and its Users: Lessons for Higher Education*. Claire is Fellow of the UK Staff and Educational Development Association (SEDA) and the UK Higher Education Academy. Together with Dr. Roisin Donnelly and Dr. Kevin O'Rourke, she coedits the *Irish Journal of Academic Practice* (IJAP).

Claire McDonnell is Assistant Head at the School of Chemical and Pharmaceutical Sciences in TU Dublin. Her interests include facilitating learner transition to higher education and the application of technology to support student learning and collaboration. She has implemented several approaches to embed research and enquiry skills in the curriculum, including context- and problem-based learning and community-engaged learning. She spent a 3-year secondment with the TU Dublin Learning,

Teaching and Technology Centre from 2013 to 2016 where she was program coordinator for MA in Higher Education. Claire is a founding member of the Chemistry Education Research Team at TU Dublin, which won a DELTA award from the Irish National Forum for the Enhancement of Teaching and Learning in 2018.

Harald A. Mieg is (Honorary) Professor of Metropolitan Studies at the Humboldt-Universität zu Berlin and also affiliated to the Swiss Federal Institute of Technology, Zurich. He was the initiator and coordinator of a German national research project on undergraduate research in Germany ("ForschenLernen," during 2014–2018; 15 universities were involved). In this context, he coordinated the edition of a series of books on undergraduate research and inquiry-based learning in Germany.

Isabelle Mirbel is an associate professor in computer sciences. Her research activities are in the fields of information systems engineering, method engineering and requirements engineering. From 2012 to 2018, she was a vice-dean of the Faculty of Sciences in charge of professional integration and relations with companies and then in charge of pedagogy. For the past two years, she has been coordinating activities to implement competency-based education within the Faculties of Université Côte d'Azur. She is also in charge of the "Sciences à la carte" project, in collaboration with the digital thematic university, Unisciel, which aims to develop online digital resources and more precisely self-positioning tests to facilitate the orientation of undergraduate students.

Jase Moussa-Inaty is Associate Professor of Educational Psychology at Zayed University. She is actively engaged in conducting research on various topics such as cognitive load, metacognition, enhancing thinking skills, blended learning, motivation, self-efficacy, science anxiety, parental involvement, and effective teaching and learning processes. She has been heavily involved in undergraduate research and was one of the founding researchers to establish the Undergraduate Research and Creative Projects symposium at Zayed University.

Margarida Romero is a research director of the Laboratoire d'Innovation et Numerique pour l'Éducation (LINE), a research lab in the field of Technology Enhanced Learning (TEL, full-time professor at Université Côte d'Azur (France) and an associate professor at Université Laval (Canada). Her research is oriented toward the inclusive, humanistic,

and creative uses of technologies (co-design, game design, and robotics) for the development of creativity, problem solving, collaboration, and computational thinking.

Enakshi Sengupta is Associate Director of the International Higher Education Teaching and Learning Association (HETL) and is responsible for the advancement of HETL in Asia, Middle East, and Africa. Sengupta is also the Director of the Center for Advanced Research in Education (CARE), Associate Series Editor of the book series, *Innovations in Higher Education Teaching and Learning*, Emerald Group Publishing. She is Managing Editor of the *Journal of Applied Research in Higher Education*, Emerald Publishing, and serves as Vice Chair of the Editorial Advisory Board of the *Innovations in Higher Education Teaching and Learning* book series, Emerald Publishing. Sengupta is Senior Manager of the Research, Methodology, and Statistics in the Social Sciences forums on LinkedIn and Facebook responsible for managing all aspects of those forums. Sengupta holds a PhD from the University of Nottingham in research in higher education, prior to which she completed her MBA with merit from the University of Nottingham and master's degree in English Literature from the Calcutta University, India. Sengupta has previously held leadership positions in higher education institutions.

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Brad Wuetherick is Executive Director, Learning and Teaching in the Office of the Provost and VP Academic and Centre for Learning and Teaching at Dalhousie University, Atlantic Canada's preeminent medical-doctoral research university. He has been actively engaged in researching, and supporting the implementation of, undergraduate research since 2003, while working at three different medical-doctoral research universities across Canada.

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CHAPTER 1

Undergraduate Research as a High-Impact Educational Practice

Patrick Blessinger and Nancy H. Hensel

Introduction

Over the past several decades, the demand for higher education around the world has increased substantially (UNESCO 2018). Several factors have fueled the growing demand. As higher-education institutions expand their services to accommodate the increased demand for education, they have also put greater emphasis on academic engagement and quality to increase student retention and graduation rates. UNESCO (2018) estimates that by 2040 nearly 600 million students will be enrolled in colleges and universities around the planet, up from 216 million students in the year 2016.

This statistic is striking when one considers that the global college-age population will reach 800 million in 2040. Much of the growth in

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college-age people will come from African countries. Also reflected in these numbers are millions of additional students who enroll in free courses through open education platforms like MIT's OpenCourseWare as well as nonformal learning platforms like Khan Academy. It is fair to say that in many countries higher education has reached a universal status, as defined by Martin Trow (UNESCO 2018). Since higher education is viewed by many as a critical factor in attaining employability and social mobility through knowledge acquisition and skill development, it comes as no surprise that many people are enrolling in colleges and universities, and other learning programs, in record numbers.

This increased demand in higher education has also created increased competition for students, which, in turn, has put greater pressure on institutions to improve their services. One way they are doing this is by implementing undergraduate research programs, mainly because it is seen as one of the most beneficial high-impact learning activities in existence (Kuh and Hu 2001; Kuh 2008). Campuses have acknowledged the documented benefits of undergraduate research and expanded opportunities for student engagement in research. It is vital to understand deeply the impact of undergraduate research so that context-sensitive ways of improving UGR may be found, whether that be small tweaks, major adaptations or implementations of whole new models (Komarraju et al. 2010; Lopatto 2006, 2007; Webber et al. 2012).

The benefits of undergraduate research include but are not limited to: improved faculty teaching performance, increased faculty–student collaboration/mentoring, increased student engagement, improved teamwork skills, increased academic achievement, higher-order thinking and inquiry skills, improved perseverance in problem-solving, and increased self-confidence. These benefits, in turn, help improve student persistence and retention.

Intellectual, psychological, and social characteristics are also crucial in preparing students for graduate studies and professional employment. In some cases, involvement in undergraduate research helps students to reevaluate and fine-tune their career choices, especially for those who may still be unsure about what graduate program or career to go into (Kuh 2008; Gentile et al. 2017).

Undergraduate research is identified as a high-impact learning practice and, as such, it is linked to improved student achievement and institutional advancement. Undergraduate research can take different forms depending on how it is utilized. With respect to scope of integration, it can be used as a one-off extracurricular activity or it can be a one-off curricular activity where it is integrated into a single course as a learning activity or it can be integrated across a set of related courses as part of a broader