Evaluating and Conducting Research in Audiology

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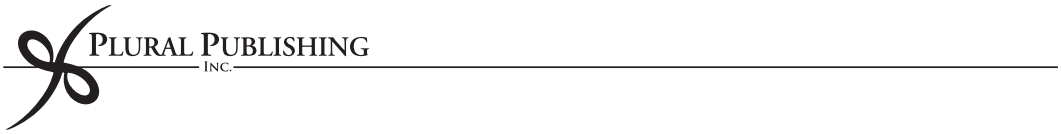

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Contents

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Foreword

No specialty is viable in the long term unless it is supported by a critical mass of vital research.

—Michael M. E. Johns, MD (Johns, 2001, p. 1185).

Historically, health care professions have often based their practices on tradition, intuition, and unsystematic clinical experiences. In the early 1990s, however, some medical professionals began to argue formally for the importance of scientific research as the basis for clinical decision making/recommendations and clinical guidelines/best practices, terming this approach "evidence-based medicine" (Clinical Information Access Portal, 2018). Today, a scientific basis for clinical care has become commonplace in multiple professions.

This evidence-based practice may be elucidated as information gathering and decision making based on scientific research findings along with consideration of the unique values and preferences of individual patients. The specific steps involved in evidence-based practice are the following (RN to BSN Online Program, 2018; see also "Section B. Evidence-Based Practice" in this book):

1. Identify the clinical problem and develop a research question
2. Gather credible evidence
3. Critically evaluate and analyze the evidence
4. Apply the evidence to answer your research question
5. Assess your results

These steps can clearly extend the utility of scientific research to the clinical arena and *transform* clinical practice. However, these steps require an understanding of the scientific research process and scientific evidence. What a pleasure to support these internationally acclaimed authors (each of whom is a researcher, clinician, and educator) in sharing their wealth of knowledge about how to close the gap between clinical research and clinical practice.

In this technological age, it's also true that many patients are well-informed, empowered consumers. These patients expect today's professionals to base their decisions on scientific research evidence and to stay informed about the most up-to-date research. Again, the knowledge provided by these authors provides audiologists for the first time with the scientific knowledge they need to do this, integrate research evidence and clinical expertise and close the gap between clinical research and practice.

Finally, another important message of this book is that the strength of our profession is based on nurturing the reciprocity between research and clinical practices. The grand object of research is to extend knowledge; the complementary role of practice is to make this knowledge purposeful and to propose new, sharply-honed

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research questions (Jerger, 2004). This give-and-take relationship may be viewed as a type of consilience that can dissolve the gap between disciplines.

If audiology is to thrive and grow into the future as a successful member of the health care professions, its clinical practices must develop a more research-based proof of efficacy. We need the kind of systematic, quantitative approach to pressing clinical issues so effectively detailed in this important volume.

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Ashbel Smith Professor Emerita
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—James Jerger, PhD
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Foreword

There is a road, but no simple highway, between the research lab and the reality of clinical practice.

—Adapted from the lyrics of "Ripple" by the Grateful Dead

Hearing health professionals are faced with an uncomfortable truth. There is a dearth of high-quality research on which to underpin much of our clinical practice. Consider the work of the National Institute for Health and Care Excellence (NICE), an independent public body that provides national guidance and advice to improve health and social care in England. In 2018, NICE published a national guideline (NG98) on the assessment and management of hearing loss in adults (National Institute for Health and Care Excellence, 2018). The full guidelines are available at their website, but a short summary is provided by Ftouh, Harrop-Griffiths, Harker, Munro, and Leverton (2018). The guidelines are structured around key areas of interest where there is variation and uncertainty in current practice. Examples of uncertainties include the following: *Are two hearing aids better than one?* and *Is monitoring and follow-up of new adult hearing aid users effective?* For 50% of the research questions addressed in the NICE guidelines, there was no evidence and for the remaining questions, the quality of evidence was generally assessed as low or very low. As a professor of audiology and a member of the NICE guideline committee, this was an uncomfortable outcome for me.

Is there really an embarrassing lacuna in our evidence base? The NICE guidelines attach considerable importance to randomized control trials (RCTs), where a sample from the population is randomized to the treatment and control groups, preferably blinded to both the participant and the researcher, in order to reduce any potential bias. Within hearing health care there are few RCTs (for exceptions, see the hearing aid study by Humes et al. [2017], the tinnitus study by Sahlsten et al. [2017], and the evaluation of an intervention to increase hearing aid use by Afzarini, Munro, Armitage, Marsden, and Dawes [in press]) and this immediately reduces the quality of the overall evidence.

A review of more than 100 guidelines published on the NICE website confirms we are not alone in lacking a strong evidence base for clinical practice. On the one hand, this is a comfort; on the other hand, it is unsettling. Can so much clinical practice be based on opinions and consensus? The quantity and quality of research studies that are cited in NICE guidelines vary greatly. For some topics, there are a great many studies (e.g., pain management) and the quality of evidence can be high (e.g., cardiovascular disease).

Evaluating and Conducting Research in Audiology is authored by Vinaya

Plural_Manchaiah_FM.indd 23 1/5/2021 1:45:25 AM

Manchaiah, Eldré Beukes, and Ross J. Roeser, who are all clinicians, educators, and researchers. This text is an attempt to address the lack of evidence within our discipline, encourage critical evaluation of published studies, and develop good research practice. The authors are an established team, having collaborated on many research projects. The chapters guide the reader through all the steps of the research process: critical synthesis of existing literature, identifying gaps-in-knowledge that are clinically relevant, formulating a carefully crafted research question, identifying both the ingredients and the recipe to follow in order to answer the question, followed by data collection, analysis, and interpretation. A considerable portion of the text is devoted to analytical statistics—a tool to be used once the results have been summarized and described. Too often, researchers jump in at the deep end, airbrush away outliers, and use inappropriate statistical methods. Even the ubiquitous "average" can lead to absurd observations if the sample combines disparate populations. An example provided by Levitin (2016) is that the average (i.e., mean) human has one testicle whereas the median value is zero (because there are slightly more women than men in the world) (Levitin, 2016). The relevance and importance of good research methods is helped by the use of examples specific to hearing health. An example is the discussion on the importance of transparency in research including the value of trial preregistration (Munro & Prendergast, 2019). Another example is the value of patient public involvement (PPI) in research. Many organizations and funding bodies actively encourage PPI because studies involving patients as research partners have shown improvements in study recruitment and participation (Bailey, Boddy, Briscoe, & Morris, 2015; Fudge, Wolfe, & McKevitt, 2007) in policy formulation (Degeling, Carter, & Rychetnik, 2015) and clinical relevance (Hanney, Boaz, Jones, & Soper, 2013; Hubbard, Kidd, & Donaghy, 2008). This may take the form of advising researchers, being a coapplicant on a research grant application, or a member of a trial steering committee. Reporting the role and contribution of patients and public in research dissemination is often overlooked. Only 11% of research papers published in the *British Medical Journal*, an influential international general medical journal, report PPI, despite the introduction of a policy to report if and how patients were involved (Price et al., 2018). This means that PPI activity is hidden, and it is challenging to understand the impact (or not). Staniszewska et al. (2017) have provided tools to improve reporting of PPI in research. It is a pleasure to see the final chapter on research dissemination. If a research question is worth answering, then it is worth sharing the findings.

There are ample opportunities for students and hearing health professionals to benefit from this textbook. The chapters on systematic reviews and evidence-based practice are directly relevant to the approach taken by various organizations (e.g., The Campbell Collaboration, Cochrane, NICE, Johanna Briggs Institute) that promote evidence-based practice. If you want to critically evaluate research, there are chapters for you. If you want to conduct research that uses quantitative, qualitative, mixed methods or surveys, there are also chapters for you.

Health care professionals, new and experienced, are well placed to propose research questions based on an urgent

unmet need, collaborate on a research study, apply for a short research "taster" session, work as a research audiologist, or undertake research training with the aim of becoming an independent researcher. A research-active workforce will enhance the reputation of the profession, as well as improve the lives of people with hearing loss.

—Kevin J. Munro, PhD

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Plural_Manchaiah_FM.indd 26 1/5/2021 1:45:25 AM

Preface

Each of life's encounters can have a profound effect, such as the serendipitous lobby meeting that occurred about five years ago during an annual meeting of the Texas Academy of Audiology. This 15-min session turned into what Malcolm Gladwell describes as a "tipping point" for the three of us, which in Gladwell's words is that "success is the result of many variables, most of which lie outside the control of a particular individual" (2000). In our case, that short encounter led to the intersection of two ambitious efforts. One of which was to help define the field of audiology around the world through the development of a website we named Global Audiology (http://www.globalaudiology.org), which is now fully functional and is actively involved in networking audiologists and stakeholders interested in audiology across the globe. The second effort was to prepare this textbook.

A premise of the book is that, as responsible health-care professionals, audiologists should strive to deliver the highest quality diagnostic and treatment services based on evidence-based practice (EBP). EBP, which is the conscientious, problem-solving approach that incorporates the most current and valid knowledge into clinical practice, should be a well-known term used in everyday service delivery. As pointed out in several chapters in this book, EBP is most desirable when developed with a combination of clinical expertise, patient preferences, and research evidence, with an emphasis placed on the importance of each of these aspects dependent on the circumstance.

Unfortunately, a recent international survey showed that when making important decisions, audiologists ranked clinical test results and patient preferences as the most important factors (Boisvert et al., 2017). However, only 20% of those surveyed mentioned the use of research evidence for decision making, and most surprising and concerning was the finding that the most frequent way decisions were made was through "discussions with colleagues or experts" and/or "trial and error." The findings from this study are disturbing and highlight the need for better education of audiologists on the applications of EBP, not only during their academic preparation but in their postgraduate daily practice. We prepared this textbook with the goal in mind of stressing the need for students and practicing clinicians to know what EBP is, to understand and accept the need for using EBP when making clinical decisions, and to be able to discern different levels and the quality of the available evidence based on existing research studies. In other words, to become sophisticated consumers of research.

A challenge in preparing the text was that the audiology profession is made up of the collective efforts of multiple branches of basic and behavioral science, including fields such as physics/acoustics, physiology, experimental/clinical psychology, counseling, and medicine/otology. This interdisciplinary nature has

Plural_Manchaiah_FM.indd 27 1/5/2021 1:45:25 AM

advanced the profession and made it stronger, but for students and clinicians alike, trying to grasp the diverse research methods from the variety of clinical and scientific fields is not an easy task. As researchers with clinical backgrounds, we understand the challenges in both the clinical and research contexts and often deliberate on how best to translate research findings into clinical practice. This means that in addition to being able to evaluate the value and quality of evidence from basic research studies, we believe that research addressing clinical issues with findings that can be applied to a clinical context are equally important. We hope this textbook will not only improve the ability of those who evaluate existing knowledge to be better, more sophisticated consumers of research but also encourage and support those who are inclined to conduct their own robust, clinically-relevant studies that can be useful in developing EBP.

Surprisingly, this is the first textbook specifically on the topic of research methods for audiology. The focus of the text is to identify the methods that are most relevant to the field, describe them in enough detail that readers will grasp their meaning, and include examples from the audiological literature to demonstrate how they are used. The target audience is students who need this exposure during their structured learning as well as practicing audiologists who need to keep current in emerging audiology knowledge and, perhaps, venture out and conduct research on their own. For students, the book aims to serve as reading for several audiology courses. For example, the book has relevant materials to serve as key reading for courses related to "evidence-based practice and the analysis of literature," "research methods," and "capstone or third year projects" that are common in Doctor of Audiology (AuD) programs in the United States. We recognize that the full text of this size and depth may be excessive for a single graduate-level course. Like other textbooks, we expect instructors to highlight the relevant chapters as key readings for the students depending on the courses they are teaching. Some of the content in this book (e.g., philosophy of science in Chapter 3) is directed at students who pursue research careers and may not be necessary for clinical degree programs. Instructors can point to relevant chapters and some chapter sections for their students to ensure the materials are suited to the course they are teaching.

The book has 13 chapters that have been divided into three sections. The first section, "Research Methods in Audiology," is the core of this text and provides detailed discussion about the research process and quantitative, qualitative, and mixed research methods. This section also includes a separate chapter on survey research. The second section, "Evidence-Based Practice," (EBP) includes chapters on EBP and systematic reviews. The third section focuses on "Conducting and Disseminating Research," which includes chapters on student-led research projects and the processes involved in disseminating research findings. In addition, various supplementary materials are provided online in the PluralPlus companion website. Readers will also see that we have included the special feature, "**Golden Nuggets**," which are call-out boxes interspersed throughout the chapters to highlight important points made in the text. The Golden Nuggets are exactly that, valuable pieces of information that relate to the

critical concepts associated with the chapter topic.

The information in the book has been classroom tested for several years by assigning key readings for AuD courses. The materials have also been reviewed and revised based on much appreciated and useful feedback from our colleagues and students. However, attempting to cover the full scope of research methods in an understandable manner has been a daunting and ambitious project. Although every effort has been made to ensure this textbook can be a desktop companion to the wider audiology community, we are fully aware that further refinements may enhance the information covered. We are keen for users of this text (students, instructors, and practicing audiologists) to contact us with suggestions to be considered in future editions (yes, we are already planning the second edition). We hope this book enhances the goals we set as we were writing it: to allow audiology students, practitioners, and faculty to use EBP in making important clinical decisions; to improve their ability to understanding and perform research; and for them to be more sophisticated consumers of research.

—Vinaya Manchaiah, Eldré Beukes, and Ross J. Roeser

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Student-Led Research Projects

You can teach students a lesson for a day, but if you can teach them to learn by creating curiosity, they will continue the learning process as long as they live.

— Clay P. Bedford (President of Kaiser Aerospace & Electronics and former director of Kaiser Industries)

Chapter Outline

Learning Outcomes

- To be able to identify the main elements of student-led research projects
- To be able to summarize which aspects to consider when defining and developing the scope of research
- To be able to outline the steps in planning and conducting a research study
- To be able to recall the importance of disseminating the outcome of research using various outlets

Importance of Student-Led Research Projects

Audiology is the primary profession providing comprehensive services to diagnose and treat those with hearing loss. That is, the focus of audiology education is to teach and provide experiences in the knowledge and skills associated with the art of audiological diagnosis and treatment. However, the literal meaning of the word "audiology" is the study or science of hearing. Together, these definitions imply

Plural_Manchaiah_Ch12.indd 407 1/5/2021 2:14:58 AM

that all those who graduate from highly regarded academic programs have first-hand knowledge of the most current audiological diagnostic and treatment procedures AND the science behind and the processes used to develop the accepted standard of audiological care.

The previous text implies that the faculty involved in audiology academic programs must provide didactic information and experiential activities in their curriculum to facilitate students in learning, interpreting, and experiencing the scientific process. To meet this requirement, many or most audiology academic programs require students to complete some form or research experience, such as a thesis or a third year or capstone project (see the following text for more detail). These research projects can be data based or can be other activities, such as a comprehensive review of the literature on a current topic of interest. The research expectations and requirements for the student majoring in audiology fall short of those for the dissertation requirement for the doctor of philosophy (PhD) research degree in that a PhD degree's major focus is to teach students how to be able to perform research independently and eventually compete for funding to support their work.

Table 12–1 is a comparison of the typical, expected components of a professional degree, such as that given to an audiology student, with the PhD research

Table 12–1. Comparison of the Typical Elements of Research Projects for a Professional Degree (i.e., MS, AuD) and a Research Degree (i.e., PhD)

Element	*Professional Degree (Capstone, Third Year Project, etc.)*	*Research Degree (Dissertation)*
Purpose	To give students first-hand knowledge and experience to become sophisticated consumers of research	To have students prove their ability to be able to conduct independent research
Typical time to complete	12–14 months	Open-ended: successful completion of the degree is highly dependent on completing the academic requirements. Generally, students take 4 to 6 years for completion.
Expected outcome	Approval of the student's faculty mentor or supervising committee; some projects are presented at meetings and published in journals	Publication in a high-impact research journal
Impact on the profession	No specific requirement	Findings should have potential impact on research knowledge/ clinical service delivery

degree. As shown, the purpose, allotted time for completion, expected outcomes, and impact of the two are significantly different. Whereas the goal of the research project for the audiology student is to provide an example of the rigors required to perform a research project and provide a hands-on experiential activity, the dissertation for the PhD student is the mandatory requirement that certifies the student as being competent to carry out significant research independently. Of note is that worldwide about 25% of students who begin a PhD program—and about 50% in the United States, many of them finishing the didactic requirements—do not finish due to the dissertation requirement, an outcome referred to as "all but dissertation" (Spaulding & Rochinson-Szapkiw, 2012). All the efforts put forth result in no terminal degree.

Golden Nugget

If the student-led research project is a mandatory part of the degree program, not completing the project may result in no terminal degree awarded despite completing all the other components of the program.

Given this, some still question the need to include research experience in audiology education. Why the need for such a research emphasis? First and foremost, knowing the objective underpinnings of clinical procedures distinguishes those who are considered professionals from those who are technicians. Technicians follow instructions; they perform a given set of instructions provided to them, while those who are at a higher level of knowledge and who understand the science behind and variables associated with a set of decisions can choose from a menu of available options when confronted with decisions that need to be made. The bottom line is that audiologists (and others) with the proper education and clinical skills can work independently or as part of a multidisciplinary team.

It is noteworthy to point out that, like other professions, the mandatory requirements for audiology education programs vary across the globe. For example, in several countries (e.g., India, New Zealand, and the United Kingdom) a typical expectation from the masters of science (MSc) is that students are required to complete a research project as a part of their degree program. The research thesis may count for a substantial amount of their credits (e.g., one-third of all the MSc program credits in the United Kingdom). However, this differs in other countries and variability between universities is also found. For example, in the United States the **capstone project** as a part of the doctor of audiology (AuD) degree is optional in some universities and mandatory in others. The reason for not having the student-led research projects as a mandatory requirement for a degree program is often not due to it being viewed as unimportant but rather due to a lack of resources. This may include not having an adequate number of faculty to mentor students during their research projects, having limited budgets for advanced equipment, or inadequate access to patient populations.

This chapter focuses on practical elements that need to be considered while developing and conducting student-led research projects. The aspects discussed

are mainly based on experiences from mentoring student-led research projects for undergraduate and graduate audiology students. However, the textbook by Valente et al. (2011) provides more detailed information regarding every step of the student-led projects in audiology.

Benefits of Student-Led Research Projects

There are numerous and important reasons for audiologists in any role to be reading the research literature regularly, implementing evidence-based findings from current research in their daily clinical practice, and even conducting and reporting results from their research studies. Clinical practice and research are intertwined—they should not be viewed as being mutually exclusive. During audiological education, students must develop the mindset that part of their future might be to think about how they would help in changing audiology practice by carrying out investigative work. Who better to know the needs of clinical service than those who practice in the clinic on a day-to-day basis? There is an often-used saying in the classroom that "Every patient is a research project" and significant changes can happen when applying this principle to regular practice. Fostering such an attitude might motivate future clinicians to go beyond simply delivering services and help them to think proactively on how and what they do in their clinical activities might result in a better standard of care and even change the scope of practice for their profession.

Beyond the possibility of encouraging graduates to conduct their own investigations, the educational experience from student-led research projects has tangible and direct benefits. First, unlike the vicarious experience of didactic courses, students are actively required to make many and sometimes difficult decisions independently, which helps to develop "independent learning and/or independent thinking" skills. Nurturing independence should be the key outcome of university education so that they can use these skills in future years to apply in practice and to be lifelong learners. Lifelong learning not only impacts professional activities but it also affects all aspects of daily living and decision making. Second, there is room in student-led research projects for students to decide what is important to them and to the extent to which they want to investigate question(s) of interest. The students also learn to create a timescale for the project. Hence, student-led research projects may help create "personalized learning," unlike other university courses. Third, student-led research projects help develop many transferable skills such as the ability to process critical information as well as time management, collaboration, and writing skills. These transferable skills add to the personal and professional development of the students. Fourth, health-care practitioners who understand the research process are more likely to use their knowledge base in making important clinical decisions; it can be argued that clinical outcomes can be enhanced if practitioners understand the basic principles of research methodology and are sophisticated consumers of research. Finally, there will always be many unanswered clinical questions. Student-led research projects can address some of these questions and can, as pointed out in the following text and later

Table 12–2. Academic and Nonacademic Skills Developed in Student-Led Research Projects

Academic Skills	*Nonacademic Skills*
▪ Conducting literature review ▪ Developing and refining research questions ▪ Understanding the research process ▪ Learning lab techniques ▪ Data analysis and interpretation ▪ Ability to integrate theory to practice ▪ Writing ▪ Communicating research outcome to broader audience	▪ Developing determination to overcome obstacles ▪ Learning to work independently ▪ Understanding the process of knowledge construction ▪ Learning the art of collaborating ▪ Improving self-confidence ▪ Experiencing realistic time management ▪ Understanding that assertion requires supporting evidence ▪ Clarification regarding career paths

in this chapter, result in outcomes that will provide data to facilitate evidence-based clinical decisions and/or serve as a foundation for future research.

As an example, a doctoral student in the Northwestern University doctor of audiology program conducted a study comparing the electroacoustic characteristics of hearing aids and personal sound amplification products (PSAPs). The findings were published in a trade journal (Smith, Wilber, & Cavitt, 2016). Soon after the publication of this research, a new Over-the-Counter Hearing Aid Act of 2017 was promulgated by the U.S. Food and Drug Association. In the absence of other relevant literature, the findings from this study served as important preliminary information in this area. Finally, student-led research projects may help to develop various other academic and nonacademic skills (Petrella & Jung, 2008). Some of these skills are listed in Table 12–2.

Golden Nugget

Undertaking a research project develops numerous skills; independent learning and thinking allow for the in-depth exploration into a topic of interest. It aids in understanding the research process when reviewing research done by others and making choices to improve patient outcomes in clinical practice.

Elements of Student-Led Research Projects

As outlined in Chapter 1, research studies generally follow a similar process. This involves selecting the topic and defining the research question(s), developing appropriate study design(s), selecting the most suitable methods, collecting and analyzing the data, considering the strengths and limitations of research, drawing appropriate conclusions, and highlighting future research directions. The process for student-led

research includes the same steps but includes additional considerations, such as the need for a supervising committee as detailed in the following section.

Selecting the Topic

The choice of topic and/or research question depends on personal, situational, and pragmatic factors. For example, students may have an interest in a specific area (e.g., adult rehabilitation, cochlear implants, hearing aids, etc.), and it may be possible for the student to find a faculty member with similar interests or expertise in the topic area of choice, providing an opportunity to discuss possible projects and research ideas. Alternatively, faculty members may have a series of questions in their area of interest and may propose some of these as possible student projects. Once the topic area is chosen, more pragmatic considerations, such as the scope and scale of the research study, need to be considered. Further discussions about defining the scope of the project will be presented later in this chapter.

Selecting a Mentor and Committee Members

In general, for audiology projects, it's common for student-led research projects to have one faculty mentor who works closely with the student during the duration of the project and is responsible for the final decision of acceptance. Having only one faculty mentor has the advantage of not receiving conflicting input from different sources, such as a possible disagreement regarding specific elements like the study design or meaning of the results. However, a distinct disadvantage of receiving input from only one mentor is that the information may be biased or sometimes even incorrect. In such cases, during the duration of the project, even though they are not officially assigned to the project, students should seek input from other professionals familiar with the research topic who may be based within or outside the university.

In some programs, in addition to the faculty mentor, the process involves the appointment of an advisory committee made up of other possible members. For example, members may have expertise in the specific subject area of the research and/or a good working knowledge of specific methodologies (e.g., use of survey tools, conducting lab measurements, undertaking interviews); and/or expertise in broader areas of research and the population of interest (e.g., adult rehabilitation, psychoacoustics, tinnitus); and/or expertise in data analysis. It is also possible to have faculty advisors from other departments or other universities. It is noteworthy to point out that such advisory committees are typical for student-led research in research degrees (e.g., master of philosophy; MPhil or PhD).

The process by which students are expected to find mentors and/or committee members varies across universities. Although it is common to provide options for students to choose them, in some universities, faculty mentors are assigned. If students choose them, the process can often result in more demand for some popular faculty and less demand for less popular faculty. Hence, depending on the workload composition of faculty within the department, the students may not always be successful in obtaining their preferred choice. This is another rea-