Teaching Statistical Research Methods to Graduate Students: Lessons Learned from Three Different Degree Programs

Ozgur Ekmekci, Adrienne B. Hancock, and Susan Swayze
The George Washington University

This paper examines the challenge of teaching statistical research methods in three master's degree programs at a private university based in Washington, DC. We, as three professors teaching at this university, discuss the way we employ innovative approaches to deal with this challenge. We ground our discussion within the theoretical framework of problem-based learning and adult learning principles. We provide brief descriptions of our research methods courses to demonstrate how an instructor can facilitate learning of new knowledge and applications in a content area often considered intimidating by students. We also highlight similarities across the three different courses we teach and pose several key questions that might help guide instructors inspired to engage students in the vital practice of using research in professional practice.

For anyone assigned the task of teaching research methods involving statistical analysis to adult learners—especially to those who have had limited to no exposure to the topic in the recent past—the task can initially appear daunting. It is not unlike what the students feel when told they are required to take a course in research methodology or statistics. For many, the initial concern of failing overshadows the excitement of embarking on a new learning journey.

The purpose of this paper is to describe our teaching experience in three research methods courses that are grounded in statistical analysis—which share similar course objectives, but have diverse instructional approaches—as we guide our students along their individual learning journeys at a private university based in Washington, DC. It is our hope that the experiences we share will encourage instructors of research methods to develop instructional strategies that allow students to acquire course content in a meaningful, rewarding, and lasting manner.

The Challenge

Many students, graduate and undergraduate alike, enroll in research methods courses with trepidation (Burgess, 1981; Edwards & Thatcher, 2004; Schutt, Blalock, & Wagenaar, 1984). An unfortunate hallmark of research methods courses is low student interest and engagement (Ball & Pelco, 2006). Faced with the task of teaching complex material to a tough audience, the instructor's frustration increases and suddenly both the instructor and the students are wishing for the term to be over. One of the most difficult challenges for students taking research methods classes is to meaningfully connect what they learn in these classes to what they learn in the rest of their plan of study, which has been the subject of extensive research (Chapdelaine & Chapman, 1999; Dunn, 2000; Eamon, 2001; Lipsitz, 2000; Winn, 1995).

The conventional model of delivering research methods classes has been the lecture model—grounded in theory, rather than practice—that usually falls short of providing an engaging learning experience for students (Benson & Blackman, 2003).

Student engagement requires motivation and active learning (Barkley, 2010), which depends on the instructor's ability to make the material relevant, provide opportunities for success, and demonstrate concern about the students and their learning (Jones, 2009; Marek, Christopher, & Walker, 2004). Eventually, classroom success becomes less about how the instructor presents content and more about how the learner relates the content to an application or experience (Marsick & Watkins, 2001)

To ensure that learners are engaged in self-directed learning and have the desire to explore content beyond the scope of formal lectures (Merriam, 2001), the instructor needs to serve as an integrated enabler of dialogue, reflection, and quality (Lawler & King, 2003). Within that context, the ultimate challenge for those assigned the task of teaching research methods becomes graduating discerning students, who not only consume existing knowledge in their fields of study, but also produce new and meaningful contributions through research and practice of their own (Marginson & Mollis, 2001).

Alternative Methods to Lecture-Based Instruction

Of the various different alternative approaches proposed to date, two stand out as the most effective: (1) the case-based method and (2) the problem-based learning (PBL) method (McBurney, 1995). Since its introduction at the Harvard Law School in 1870, the case-based method has been widely used in both law schools and business schools (McBurney, 1995) to allow students the opportunity to investigate and discuss real-life problems from a number of different perspectives without necessarily asking the students to

find a particular solution. The problem-based learning approach, on the other hand, was initially introduced in North America in the 1960s to facilitate critical thinking amongst medical students (Ball & Pelco, 2006; Savin-Baden & Major, 2004) and has since been used to promote self-directed learning aimed at increasing motivation, retention, and critical reasoning (Ball & Pelco, 2006) by challenging students to solve real-world problems. While working through a case has its own merits, not all students in a given class may personally relate to the case being investigated. The lack of this personal connection, combined with the focus on mainly identifying facts, rather than formulating a solution (Ogden, 1984), renders the use of cases somewhat ineffective in research methods classes (McBurney, 1995).

In contrast, the problem-based learning approach—especially one where the students are asked to develop their own personal research project—has been suggested to be the most effective way to build experiential learning into research methods courses (Marek et al., 2004). Having students develop their own topics for research, ground their study in the literature, and create research designs increases students' engagement in the research course (Ball & Pelco, 2006). Furthermore, studies suggest that adding the dimension of peer review into the process, whereby students get a chance to explore and evaluate one another's work, enhances the overall learning experience (Ledman, 2003; Topping, 1998; Zablotsky, 2001).

The Role of Adult Learning Theory

Fitzpatrick and Turner (2006) indicate that while nearly 75% of college students were between ages 18 and 21 in 1970, this ratio has dropped to just above 55% over the next 25 years, indicating a major shift in student demographics in college enrollments. With more adult learners in higher education, it seems that there is more need now than ever to develop teaching approaches that are grounded in seminal adult learning principles, which emphasize the importance of creating a learning environment that: (a) is comfortable and non-threatening, (b) is designed around learners' needs, (c) builds and enhances learners' self-esteem, (d) encourages active and self-directed participation, (e) acknowledges and utilizes learners' past experiences, and (f) allows learners to monitor progress towards set objectives (Dewey, 1933; Goodlad, 1994, 1997; Knowles, 1970, 1973).

Critical reflection (Freire, 1970; Mezirow, 1998), which involves acting on one's newly acquired insights and then critically reflecting on such actions, and the learning taxonomy (Bloom, 1956), which describes the hierarchy through which individuals ascend on their way from becoming aware of knowledge all the way to being able to evaluate the value of knowledge in a particular domain, are two fundamental concepts that strongly influence adult learning. Garrison (1991) and Brookfield (1995) argue that in order for learning to be meaningful, the cognitive process needs to involve critical thinking that is grounded in the analysis, synthesis, and assessment of newly acquired knowledge. When applied to mastering research methods, this argument means that students need to be in charge of their learning and take an active role in determining the context within which they acquire new content (Edwards & Thatcher, 2004).

Our Teaching Experience

In the following subsections, we outline the teaching approaches we use in three distinct settings—structured around problem-based learning methods and informed by adult learning principles—so provide our students with a learning experience that is engaging, rewarding, and lasting.

Teaching research methods in an on-campus clinical master's program. The graduate research methods course in the Department of Speech and Hearing Sciences serves as an introduction to quantitative research design and statistics. The overarching objective is for students to be critical evaluators of research in speech-language pathology so they can use research to guide their practice. Typically in this process they also become capable of producing sound research, although the students typically don't believe this until the last few weeks of the semester. In this program, research design and statistical methods are taught together in one three-credit course and no other research courses are required. However, most of the required courses and clinical rotations involve reading and using research literature. Master's is the entry-level degree for both speech-language pathology and knowledge and demonstration of skills in research methodology is required by the accrediting body.

As clinicians, students will be expected to utilize the three aspects of evidence-based practice: empirical research, clinician expertise, and patient needs. The empirical research aspect is foundational and crucial to the clinical process, yet it also can be intimidating for many students. In our experience, speech-pathology students don't intuitively realize that they already know how to do much of what is required for empirical research.

Every day, speech-language pathology clinicians measure behaviors and compare those measurements to established normative data. They implement treatments and measure changes they can attribute to that treatment. They consider the various factors that could be influencing behavior or the effectiveness of the

treatment. By taking time to show student clinicians the parallels between clinical practice and clinical research, some of the fears are quelled, and the rationale for engaging in the course content is kindled. A major motivation to engage and learn the scientific process is established when students view research as a means to improve their clinical services for the patients they care so much about. The instructors can't promise the course will be easy, but they can show students it will be worth it.

After just one semester of academic and clinical experience, the speech-language pathology students are brimming with clinical questions like, "What's the best way to teach my client with autism age-appropriate social skills?" Somewhat surprisingly, they don't view these as research questions. In class, their questions are shaped into measurable, feasible, and novel clinical research questions. Students are encouraged to claim ownership over their individual questions and proceed to compile a literature review to support their rationales. This review often starts with articles found when searching for guidance on how to treat a previous client. Therefore, each student starts with her own "problem" of determining a treatment plan and, through the process of solving the problem, learns about research and experimental design.

Although most students are familiar with searching web or library databases, a session with the librarian often helps them streamline the process and improve their efficiency at finding relevant and respectable information. As the class reads about variables, designs, and measurement, the students bring the terminology to life by applying it to the articles read for their literature review or previous clients and eventually by designing a study that could answer their individual questions. Often students comment that they didn't see the big deal about confounding variables until they began listing all the variables to control in their own study. To this, instructors point out that in clinic they think about all the factors influencing the client's performance, again drawing a parallel between what they already do in clinic and what is done in this new context of empirical research.

Many students initially get a glazed-over look of fear and confusion when statistics are mentioned; however, as we sift through the analysis options in class they begin to identify that Jennifer and Sarah have *difference* questions whereas Leslie's question is really about relationships between her variables. Because they are familiar with each other's studies, they get to practice finding an appropriate design and statistical analysis several times. Instructors provide the knowledge framework and help students understand how to consider the type of question and design when selecting a statistical test. Then the class works together to understand what the options would look like in real

life, needing relatively little guidance from us. This has proven much more engaging and effective than lecturing about each type of statistic, even with examples. In fact, it is also more enjoyable and satisfying for all involved. While we do not have the time or resources for each student to carry out the study after they write a literature review and prospectus, they at least formulate a hypothesis and write their expected results.

Students trade papers for guided critique after the introduction, method, and expected results, and again one final time before grading. Not only does the feedback enhance the final product for the author, the reviewer gets involved at a deeper level with a question and design other than her own. Also, as instructors, we get an opportunity to evaluate the reviewers' carryover of knowledge and determine how they use analysis and evaluation skills. Occasionally, at this point, instructors realize some students may have a very narrow understanding of research design or statistics and can apply it only to their own research scenario. In this case, the paper that particular student is reviewing becomes another teaching opportunity to expand student understanding. Furthermore, students learn the value of peer evaluation to an individual as well as in the publication process.

After a semester of rigorous thinking and writing, students are proud of their unique and interesting products. In order to foster that sense of pride and ownership, during final exam week the department hosts a poster session. Each student makes a poster displaying the rationale developed from literature review, research question, method (participants, materials, procedure), and expected results. Faculty, staff, and students in the department walk through the poster session and talk with students individually. The student is empowered as the expert on her topic and feels secure enough to provide a professional opinion and brainstorm ideas with the attendees. The atmosphere is relaxed, but full of energy, as professors are impressed and students feel a sense of completion and accomplishment. A few will even continue on and turn their idea into a Master's thesis.

Teaching research methods across multiple on-campus master's degree programs. In the Graduate School of Education and Human Development (GSEHD), all Master's Degree students are required to take an introductory research design course entitled, Introduction to Quantitative Research. This course is required because GSEHD is committed to ensure that all its Master's graduates are "strong consumers" and c"ritics of published research." There are 18 Master's Degree programs within GSEHD that range from elementary education to counseling and human resource development. Given that numerous sections of Introduction to Quantitative Research are taught each

semester to fulfill the needs of students, the course is taught by seven full-time research methods faculty, as well as numerous adjunct faculty members. Thus, not only is there program diversity, but also diversity among the faculty members leading the course.

Due to great variation in terms of the contextual background in which we need to ground the subject, our students come with a variety of background knowledge, so the instructor embarks on the challenge of diversifying examples and creating assignments that can be tailored toward one program or another. Moreover, given the quantitative nature of the course, the typical evaluation methods may also be unlike those encountered in the content courses. Add to this the need to engage adult students, who may not have taken or excelled at quantitative courses in their past, the challenge becomes even bigger. In order to adequately address the needs of our diverse student population, we take a four-pronged approach to: (1) set the tone for success; (2) make the material applicable; (3) play an evaluative role; and (4) directly tie the course objectives to course deliverables.

Initially, we communicate the tone for success in the first class meeting. We begin the course with a discussion of how to be successful and explain that the students are empowered to succeed in this course regardless of past experience with quantitative subjects. Additionally, we encourage students to help each other succeed through note-sharing, study groups, and students quizzing students, in an effort to support the success mantra and to instill in the students the belief that they can all succeed together.

Additionally, we customize the course material to match the targeted learning objectives of each master's program. Therefore, we provide examples that associate what can be distinct concepts to current issues in the students' educational program. Furthermore, we associate research concepts with daily life, which encourages the student to see research as associated not only with education, but also in their daily lives such as in news reports in the media. This association enables students to retain the information – not just study and then dump it. For cohorts of students that are in professional settings (e.g., school or clinical), we provide a problem-based learning assignment in which a group of students select a topic of their choosing, research how others have addressed the problem, and then create a design by which to address the problem. This technique increases the likelihood that students will take ownership of their learning, in addition to retaining the concepts and material provided through the course.

Students are asked to evaluate a published empirical article either of their choosing or a faculty-selected empirical article to evaluate as both a practitioner and a researcher. They focus on the validity and reliability of the published study from two perspectives. First, as a practitioner, they reflect on the following questions:

- Does this study have face validity?
- Did the researchers ask the right questions and use the correct tools?
- Did the researcher provide sufficient information so that you as a practitioner could replicate the study?
- Are the study findings generalizable to a typical setting or was an artificial setting created for the study?

Then, the student is asked to evaluate the study as a researcher, guided by the following questions:

- Were the appropriate prior studies referenced?
- Were contrary studies left out of the literature review?
- Was the design that was used appropriate for the study? Was the correct terminology applied?
- Were the conclusions made justified based on the study findings?

Such questions provide an opportunity for using their practitioner knowledge, as well as the new knowledge gained through the course.

Finally, the instructor links course objectives with course deliverables, thereby increasing student understanding of the course objectives and buy-in into the course deliverables. Given that many students are educators, how a course is taught can have an effect on student satisfaction with the course and comprehension of the material. One course objective is, "Recall and define terminology associated with quantitative research." This objective is measured by the extent to which students recall and define terminology on timed exams such as quizzes, midterms, or finals. Another course objective is, "Apply new knowledge." This objective is measured by the extent to which students adequately critique a quantitative research article or create a problem-based learning proposal. By making the link between the course objectives and course deliverables transparent for the students, their buy-in into the course overall and the course deliverables is increased. Taken together, setting the tone for success, making the material applicable and relevant, and directly tying the course objectives to evaluation tools creates the environment for student success in a course that is often feared.

Research methods in a distance education master's program. The Department of Clinical Research and Leadership within our university's School of Medicine offers degree and certificate programs in

Clinical Health Sciences, Clinical Management and Leadership, Clinical Research Administration, Regulatory Affairs, and Health Care Quality. The programs are grounded in an interdisciplinary approach and generally target practitioners interested in formalizing their educational and professional accomplishments through a degree or certificate in their field of study. The students in these programs are mainly health care professionals with a significant amount of work experience.

All of our graduate level programs include a two-course Research Methods series that focuses on the design and methods of research within the contexts of health professionals, health systems, and health policy. By taking our students through this series, we want them to be able to pick up a research article in a journal and really understand the messages that the authors are conveying. We want our students to become even better clinicians by putting them in a position to evaluate research articles and figure out what the results mean for their patients. Even better, we would like each of our students to come up with an original research question and then to develop a study designed to answer it. We firmly believe that the ability to evaluate and interpret published research is an essential skill for not just our students but for all health care providers.

In Research Methods I, the first course of the series, we ask our students to put together a research proposal that could actually be implemented, although they are not asked to collect data or carry out any analysis. Throughout the course, we cover the following: understanding the role, importance, ethics, and types of research; selecting a problem; reviewing existing research; sampling; threats to validity in design and measurement; and data collection. At the end of this course, our students have a design that, if they wanted to, they could implement.

While in Research Methods I, we teach our students how to develop a comprehensive research proposal that is grounded in quantitative inquiry, in Research Methods II, we build on that knowledge by introducing statistical methods and ways to create meaning from raw data. In this second course, students learn about descriptive and inferential statistics, as well as how to apply correlation, t-tests, ANOVA, and Chi-Square, as part of a proposal, to answer a specific research question. The emphasis of the course is on applying statistical methods to test hypotheses, using data sets on SPSS (statistical software package).

As we expose our students to various statistical methods, we want them to be able to understand and explain to others the statistical analyses they encounter in research reports they read. Also, we want our students to be able to identify and carry out the appropriate statistical procedure for many basic research situations. Another very important learning

outcome that we try to instill in our teaching is for our students to be able to master their quantitative and analytical thinking skills.

In this two-course research series, we ask that our students pick an organization with which they are fairly familiar—preferably the one for which they are working—and identify a research question grounded in that particular organizational context that they would like to investigate framed within the boundaries of a comprehensive research proposal. As instructors, we provide regular feedback to each student throughout the proposal development process, constantly encouraging them to envision what they would do and how they would do it. Through such feedback, we also ensure that they properly align all of the research components they have learned in their presentation. Since we work in a learning environment where the instructors and students hardly ever get together in the same space and time, we record and post weekly video lectures to provide collective feedback and guidance, in addition to the individual level feedback we provide each student.

Toward the end of both courses we ask our students to engage in a small-group activity that entails role-play-based peer review. In this activity, we divide the class roster into groups of three and ask that each student provide feedback to the other two colleagues on their papers. However, what sets this activity apart from many other traditional peer reviews is the fact that we ask our students to engage in role-play and write a one-page decision letter to their colleagues.

When we first started offering research courses, towards the end of the semester—a week or two before the students handed in their final assignments—we would ask that they post it in the discussion forum for their colleagues to see and critique. What we realized after a couple of semesters was that many of the students were providing generic—and largely favorable—comments, such as "Great job!," "Loved your proposal . . .," or "Keep up the great work!," without providing much substance or help. At that point, we felt like we needed to do something different to facilitate a higher level of thinking and feedback.

The very next semester, we decided to change the instructions for the peer review activity, whereby we introduced a role-playing format which we thought would enable the students to be more critical and constructive in their reviews, without being terribly concerned about offending their colleagues. In Research Methods I, where students were developing a research proposal, we would ask them to be the president of a major foundation reviewing grant proposals for funding. As part of their role, each student would review the proposals of the two other colleagues in the group and write each one a single-page, double-spaced letter informing the applicants of the foundation's decision to fund (or not fund) the research

proposal based on its merits, along with a brief explanation of why (or why not).

We applied the same format in Research Methods II, where students were developing a comprehensive research report (that also contained statistical analysis). In this course, we would ask our students to play the role of a senior editor in a research journal, whereby they would review the reports of the two other colleagues in the group and write each one a single-page, double-spaced letter informing the authors of the journal's decision to publish (or not publish) the research report based on its merits, along with a brief explanation of why (or why not).

As soon as we switched over to this format, we saw a significant improvement in the quality of feedback coming out the peer review process. Now that students were writing formal letters to one another, they used critical thinking in their evaluation and they were challenged to justify their position—whether it was a favorable one or not. Students were excelling beyond single-line comments. They now demonstrated the ability to be analytical, critical, and constructive. Peer reviews and group discussions about the research questions imply that the instructor is not the only one that can have a good idea or a valid point. Students can feel empowered by sharing responsibility for learning and become more invested in the outcomes.

This role-playing activity, to date, has turned out to be the most innovative and enjoyable learning activity in the research series. While it is a relatively simple exercise by design and it is the very last thing we do in class before students hand in their final assignments, it is highly personal and very effective in terms of its ability to facilitate a meaningful and constructive conversation among our students, which directly feeds into the improvements they make on their final assignments right before they hand them in. This activity, by its very own design, also simulates real-life situations that students will find themselves in—utilizing and critiquing research and possibly submitting grant proposals.

The Common Threads

The three cases we have presented above describe how the approach to teaching research methods courses may vary depending upon degree program (i.e., professional context) or delivery format (i.e., learning medium). However, there are two common threads that become apparent—namely, in all three cases presented, the instructors: (1) foster open communications, built on encouragement, trust, and critical reflection that allow students to be more active and engaged; and (2) create meaningful and relevant assignments, grounded in the practical realities of the workplace, that allow students to more easily create new meanings out of

their existing experiences. Creating this type of learning environment allow students to personally own the problems they are trying to solve and enable them to take charge of their development process.

Additionally, all three instructors take the time to validate students' feelings of anxiety and to uncover the source of such deeply engrained fear of research and statistics. Some careful explanation and assurance that the course is designed to inform and demonstrate the value of research and not is not meant to leave students stranded on islands with complex course material often helps students dispense their initial anxiety. Particularly with adult students, creating course assignments that are applicable to professional work is an effective way to entice the student to take an open attitude and join the learning journey, as their past experience provides them with safe harbors while they navigate through unfamiliar territories.

Conclusions

In light of our teaching experience, we would like to propose some key considerations for those who will be teaching research methods classes. We feel that, from the teacher's perspective, asking certain questions might make a meaningful difference in terms of how learners acquire and apply the content. These questions consist of, but are certainly not limited to, the following:

- Question: Am I explicitly stating that, as an outcome of attending this class, students should expect to become more informed and discerning consumers of research, in addition to becoming producers of new knowledge?
  Implication: Ensure students become more selective in the way they choose and utilize existing research based on the merits of credibility, validity, and generalizability.
- Question: Am I setting the tone for success before each session?
  Implication: Ensure students understand what success will look like and how they are likely to achieve it before being challenged with course assignments.
- Question: Am I creating a comfortable and non-threatening learning environment where students are not intimidated?
  Implication: Ensure students can solely concentrate on learning, without being distracted by perceived obstacles and threats.
- Question: Am I clearly communicating that I expect critical thinking to inform and guide all class activities?
  Implication: Ensure students grasp the crucial role critical thinking plays in their learning experience and can harness its power.

- Question: Am I creating a sense of ownership among students by including them in the way I plan the delivery of content and evaluation of their progress?
  Implication: Ensure students become major stakeholders in their own learning contract and actively seek their best interest.
- Question: Am I including peer reviews through which students can connect with others' research ideas and engage in meaningful conversations?
  Implication: Ensure students take on and serve the role of being teachers in addition to their traditional role of being learners.
- Question: Am I making the research content relevant to match students' past experience and future career objectives?
  Implication: Ensure students can draw from the strength of their existing experiences and use the known to conquer the unknown.
- Question: Am I drawing parallels between research and practice that will allow research to guide the way students practice?
  Implication: Ensure students can see the connection between what they learn today and how that might influence their future behavior and those of others.

Regardless of how these questions may be phrased, our teaching experience suggests that the seminal principles of adult learning (Goodlad, 1994, 1997; Knowles, 1970, 1973) have the potential to effectively inform and guide the way we teach research methods. Consistently applying these principles in our classrooms might help us develop life-long learners who are autonomous, self-directed, engaged, confident, discerning, and accountable. When teaching research methods, this type of development goes a long way in terms of giving us confidence that our students are acquiring the right mind set that will serve them well—not just during their time with us, but also throughout the course of their future professional development.

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OZGUR EKMEKCI, Ed.D., is an assistant professor at the Department of Clinical Research and Leadership within the School of Medicine and Health Sciences at The George Washington University. Dr. Ekmekci also serves as the program director of the Health Care Quality Master's Program at the same university. He teaches courses on leadership, organizational change, research methods, and health care management.

ADRIENNE B. HANCOCK, Ph.D., is an assistant professor in the Department of Speech and Hearing Science at The George Washington University. Her research addresses voice disorders and transgender communication, as well as evaluation of teaching and assessment practices in higher education.

SUSAN SWAYZE, Ph.D., is an applied researcher who has conducted quantitative and qualitative research studies for diverse organizations ranging from academic institutions, government agencies to corporations. As an assistant professor at The George Washington (GW) University's Graduate School of Education and Human Development, Dr. Swayze teaches both quantitative and qualitative research methods and statistical analysis courses.