Research Methodology: An Innovative Approach to a Venerable Course

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Abstract

This paper outlines a number of innovations that we have recently implemented in the Research Methodology Course at the University of Michigan's School of Public Health. Consistent with the goals of evidence-based medicine, evidence-based public health, intrinsic motivation, and phase 4 (T4) translational research, we have placed the emphasis on enhancing the students' desire to learn—and more specifically on their desire to learn rigorous methods for conducting useful research that delivers practical benefits in a straightforward manner. A dozen innovations, along with some preliminary outcomes, are outlined in detail. Clin Trans Sci 2010; Volume 3: 309–311

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The introductory class in research methodology has been taught for many years at University of Michigan's School of Public Health, and recently, a number of innovations have been introduced that have changed the course substantially. It has always been a challenging class for the instructors, in part because the students are so diverse academically; for example, this year our enrollment includes two physicians, 20 first-year MPH-graduate students, half-a-dozen second-year MPH students, and an undergraduate in the accelerated BA-MPH program. Having taught the course recently as a team, we have now handed responsibility back to a single teacher (the first author) and have collaboratively redesigned the curriculum to expand some of the innovations that were instituted over the years by the second author. The end result is a combination of a few traditions and a number of innovations that place the class squarely at the intersection of two important theories: evidence-based medicine (and the related discipline of evidence-based public health) and intrinsic motivation. And, as a recent article in *Clinical and Translational Science* points out, the effective education of new researchers is of critical interest to members of the Clinical and Translational Science Awards (CTSA) community.[1]

Although few advocates are aware of the fact, the original concept of evidence-based medicine grew out of important work in adult education; indeed, many writers[2] trace the development of evidence-based medicine back to efforts at Yale Medical school, where a working group sought to make medical students committed life-long learners who were willing to evaluate new sources of evidence and adopt new methodologies derived from emerging research in peer-reviewed journals.[3] Accordingly, evidence-based medicine (and the related fields of evidence-based nursing, evidence-based public policy, evidence-based rehabilitation, and evidence-based management, to name but a few) can trace its roots back to research on intrinsic motivation[4] and work in education with adult learners.[5,6]

Our emphasis is on intrinsic motivation—the notion that intangible rewards such as the pleasures of intellectual challenge and a sense of growing mastery, may sometimes eclipse conventional "extrinsic" rewards such as monetary gain and letter grades, as a recent paper in *Science* shows.[7] The new focus of the class has interesting implications for CTSA programs because our emphasis is on helping students learn to think critically and creatively through classroom tasks that encourage utilization of the cognitive skills necessary to translate research into practice. Students in the class are now encouraged, even required, to consider how issues outside of the topic they are specifically studying can help them think about, and provide, new perspectives on their own research. This skill is vital for phase 4 (T4) translational research, where we evaluate "real world" outcomes (i.e. application of research to community practice) because translational research requires considerations beyond scientific method so that outcomes can address cultural and contextual issues. Most research training, however, does not help students consider practical implications of their work. Our course comprises predominantly Master's in Public Health students who are often the front lines in translating research to community programs. Accordingly, we have designed the course so that it prepares students to generate practical translational research whose outcomes can provide straightforward guidance for community-based health promotion programs.

It is arguably true that our current approach to the class is entering some new territory. As we describe below, even though the class has not yet run its full course, we are already seeing some surprising outcomes that are consistent with the mission of our nation's CTSA programs and the goals of evidence-based medicine. In the interests of passing along the essential components of our practice to other educators who share our interest in research methodology, here is a partial list of the innovations.

(1) **We de-emphasize grades and put all our emphasis on enhancing desire to learn**: Students are told on the first day of class that the goal is not to enhance or preserve their grade point average (GPA), but rather to enhance and preserve their desire to learn. And specifically, enhancing their desire to learn practical and interesting things about the research in public health that will make the world a better place. It is an odd thing to tell students: The goal is not—strictly speaking—to expand their body of knowledge in research methodology *per se*, or to get the top grade, but rather to expand their desire to learn about research methodology both during the class and well after its final meeting at the end of the semester.

(2) **Each class starts with a brief paideia session**: During the first 5 or 10 minutes of every class, we start with an intellectual appetizer that reminds students how pleasant and gratifying it is to learn something new. Often, these are open discussions where the instructor points out a subtle but fascinating aspect of a painting, piece of music, photograph, folktale, or piece of literature. For example, in recent paideia sessions (a tradition from Reed College based on the Greek term for education, where the students give classes on a wide

variety of ostensibly irrelevant topics) we analyzed Renoir's Umbrellas, a photograph of lions drinking at a watering hole, a Chinese folktale about an expert who knew the secrets of differentiating genuine jade from imitations, and a passage from the Knight's Tale in the Canterbury Tales. The key to these intellectual appetizers, of course, is that they seem irrelevant, but actually have direct bearing on the task at hand. For example, before we covered Stevens' wonderful work on four types of measurement scales, we analyzed a pair of poems by Yeats…one of which builds up to a crescendo where the poet claims "Measurement began our might." About half way through the semester, students began sharing responsibility for these Paideia sessions, where their general assignment is to tell a story that describes how they learned something new and unexpected. Recent topics from students have included, How I learned to drive a stick shift, How I learned to dance "improv" after years of formal ballet training, and How I learned about the durability of rumors— even obviously erroneous ones that I started myself.

(3) **Students post their papers and announcements in an open forum**: We give students access to the course's website page where instructors typically post announcements. (At University of Michigan, all instructors are given access to a CTools website for each class.) This password-protected website allows students to make announcements and pose queries to the whole class; and we use the same web-based tool to have students post their work, so that all the students in the class can read each other's papers. Because many (but not all) of the class assignments are completed by a group of students working together, it is sensible for students to share their work on the class web page, so that group members can create and edit their final product collaboratively. By allowing each student to see the work of all the other students both before and after an assignment is due, we introduce students to the whole idea of peer review: that is, students can read each other's work just as colleagues read each other's published papers, and—contrary to the expectations of some—the end result is less redundancy and higher quality.

(4) **We stress evaluation from the first moment to the last:** Early in each class, we review errors and inaccuracies in the assigned readings. For example, even though we are using some great articles and the most recent edition of a very good textbook, (*Approaches to Social Research by Singleton & Straits)* there are still passages and claims that students are asked to take with a grain of salt. For example, Singleton and Straits[8] unfortunately blur the distinction between statistical significance and effect size—a matter of critical importance in public health research, where effect size is often modest.

(5) **The "final exam" is a knowledge inventory:** On the next to the last class, we hand out a list of all the concepts and terms covered in the class. The students go through the list, and determine whether or not they could provide a definition and a brief description of why the concept or term is important. These inventories are anonymous (and students get to keep a copy). The results tell the instructor what has and what has not been covered sufficiently. In other words, the final exam is not to evaluate the students' ability to absorb all the course material; rather it is to evaluate the teacher's ability to *communicate* about that material. And students using this tool in previous classes (on survey design, as part of

the Summer Institute in Survey Research Techniques at the University of Michigan's Institute for Social Research), have volunteered the fact that they used it to identify the topics where they felt their grasp of the material was insufficient.

(6) **We provide an optional review of statistical concepts:** Early in the course, we offer an optional evening class that reviews the concepts underlying about a dozen common statistical tests. The goal is not to help students memorize formulas, but instead to learn about the usefulness of different statistical tests in different circumstances. Moreover, we provide links to web-based calculators that run these simple tests (e.g. correlations, the cumulative binomial, *t*-tests, tests of statistical power, tests to determine sample size, the chi-square) and list the underlying assumptions that should not be violated when the test is used with actual data. The material is helpful for students who have not yet completed a statistics class, and (because many students have just started their first course on statistics) a surprisingly large proportion of the class chooses to attend.

(7) **Students introduce themselves to each other with a write-up and a photo:** Because the students have to form seven or eight working groups to complete collaborative assignments, it is imperative that they get to know each other quickly. This approach seems especially timely, given the fact that translational research is increasingly conducted by diverse teams that span numerous disciplines.[9] A brief description of their interest in public health, along with a photo, allows students to coalesce naturally into groups that are centered on their common interests…not just the fact that they happen to sit near each other on the first day, or catch each other's eye when it comes time to select a colleague for a shared project. Moreover, because these sketches and photos are mounted as an announcement on the class's CTools web site, students can edit them if they feel that a revision is desirable. A "knock-on benefit" (as they say in Britain) is that students begin to build trust, right from the first meetings, with constituents who share their interests; it helps us build a supportive environment that highlights cooperation and discussion, rather than competition. By requiring collaborative work on tasks of increasing complexity, the students get a supportive introduction to a work style that they will need to utilize frequently during their subsequent professional careers; in fact, the student's final project is an R-21 grant proposal written and presented to the class by each of these seven working groups. And the topic of these simulated R-21 grant proposals, of course, is the central interest of the working groups, which this year includes groups on injury prevention, health disparities, chronic disease, sexuality, mental health, international health, and nutrition.

(8) **Students define their own goals at the first class and evaluate their progress at the last class:** We open the course by asking students to write a sentence or two telling us what they want to be able to do at the end of the course that they cannot do currently. These are handed in (with the student's name) and used to set the class goals. That is, the goals are not predetermined by the instructor, but rather by the students themselves. During the last class students see the goal they established on the first day, and they are asked if they met their objective—a simple yes or no question. Those responses are written down on the original page for the instructor's benefit, and the students are given a copy for their own

benefit as well. It is an innovation that we highly recommend for a number of reasons that a moment's reflection reveals.

(9) **The class is a hybrid that combines lecture and seminar format:** Just as the class is designed to foster the student's intrinsic motivation, it is also planned with an eye on the instructor's intrinsic motivation as well. Reviewing content from the reading and textbook are largely unnecessary for bright graduate students (although clarification of important or complex issues is usually welcome). Similarly, a one-to-one review of each issue covered in the reading is bound to wear down an instructor after just a few cycles. A better approach combines the review that is typical of the lecture format with the independent discussion and evaluation of new research typical of a high-level seminar.

(10) **We analyze published abstracts and papers "at the drop of a hat" and without preparation:** Instead of using pop-quizzes or demands from the teacher to answer an unexpected question during class discussion (traditional tools that enhance participation by inducing anxiety), we frequently distribute a copy of a recent abstract or article and ask the class, as a group, to provide a critique. Moreover, these discussions always end with an open floor discussion, where we talk about how we would suggest improving the research. For example, in a recent critique of four recent abstracts from the *American Journal of Public Health*, our students suggested a better method for evaluating the effectiveness of a program limiting access to ammunition in Baltimore. And that was not a fluke. In other evaluations of published research, the class formulated a new approach to measuring homelessness, and—all on their own—came up with an insightful measure for evaluating the effectiveness of a program to promote self-care among the burgeoning population of high-school students at risk for diabetes to improvement in the subject's ability to predict his or her own blood glucose level.

(11) **We encourage students to pursue their own individual interests:** One of the major projects in the class asks students to evaluate a published research report…not an unusual requirement for a class on research methodology. But in our case, we ask each student to find and evaluate a unique paper that no other student has selected, and that fits well with *their* current interests. So, even though this expands the workload substantially (because it requires the instructor to review 30-dissimilar published reports, and 30-dissimilar student papers), it brings the task into the student's own domain of interest, rather than requiring that he or she try to bring their interest to a topic that the instructor has preselected. (This evaluation is, not incidentally, written by the student alone; the other major class assignments are all produced collaboratively by the students and their working groups.)

(12) **We treat students as if they are brilliant and motivated, and they respond in kind:** As much research over the last quarter century shows,[10] teachers' expectations matter. Moreover, in our class the students consistently do brilliant work that far surpasses the minimum requirement. For example, on an open-book quiz where the task was to collaboratively create a quiz containing 16 questions, every single one of the seven working groups in the class produced *more* than was minimally required by the assignment…and there was no offer of extra credit for doing the extra work. One group wrote 22 questions, another handed in the assignment 1-week ahead of its due date, another had two sets of possible responses for a multi-part question, one containing four elements stressed by the text, and one containing different elements stressed during a class lecture. Without being prompted or tangibly rewarded, not a single working group produced only the minimum requirement.

Our approach seems to be working; when was the last time you heard of students consistently producing *more* than the minimum requirement? When was the last time you heard of students applauding the speaker after she told the class about her humorous (and touching) experience learning to do something she thought she would never be able to do? And, when was the last time you heard about a group of students spontaneously inventing a really practical and insightful measure to evaluate program effectiveness? Will the approach work in the long run? We will see; we already have measures in place that will allow us to evaluate (and improve) the class as we move ahead. We are gratified by the encouraging results so far. However, in truth, if the value of this approach continues to be borne out, it will be the students, not the instructors, who deserve the credit.

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