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Teaching Research Methods to Undergraduate Psychology Students Using an Active Cooperative Learning Approach

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Many undergraduate degree programs require students to develop a basic understanding of research methodology. Unfortunately, methods courses are typically unpopular with students because the course material is complex and technical in nature. Consequently, some instructors supplement traditional lecture-text classes with active learning experiences such as a student-developed research project. This paper describes a research methods course in the social sciences (psychology) based solely on multiple student-developed research projects. The paper highlights the strengths and weaknesses of this non-traditional approach to teaching research methods.

The completion of an introductory course in research methods is a critical step for undergraduate students who will one day need to conduct their own original research. These courses are equally important for students who are not planning to conduct research in the future, because graduates still need to make informed decisions regarding research findings as part of their professional development (Zablotsky, 2001). Consequently, research methods courses are a staple and essential requirement of many undergraduate programs in the social and natural sciences.

Research methods courses are challenging classes to teach because the technical complexity of the course material is quite high while student interest in this material can unfortunately be quite low. In the field of psychology, current research methods texts typically survey both qualitative (e.g., discourse analysis) and quantitative (e.g., questionnaire survey) methodologies. In addition, specialized methodologies in psychology range from single-subject procedures (e.g., single-subject discrete trial) to procedures involving thousands of participants (e.g., archival database analysis). Furthermore, the variety of techniques currently available to measure psychological variables ranges from technically sophisticated brain measures (e.g., fMRI and ERP) to subjective interpretations (e.g., Rorschach and Draw-a-Person). If this coverage of methods and terms was not daunting enough for both students and instructors, a further goal of most research methods courses is to teach students how to present research findings in both oral and written form using the scientific style and format dictated by each professional discipline. For psychology students, this requires an introduction to the stylistic and formatting nuances found in the 400-plus pages of the *Publication Manual of the American Psychological Association* (American Psychological Association, 2001).

Many excellent introductory textbooks are available that provide some coverage of the major methodologies and techniques used by social scientists. The majority of these texts follow a fairly consistent organization with each chapter covering a general research topic (e.g., ethics, theories, statistical analysis, presenting research) or a specific research methodology (e.g., survey, experimental design, quasi-experimental design). Typically, instructors use the structure provided by the text to organize classes throughout a semester or yearlong class. Most textbook publishers also provide supplementary materials, such as exams and review questions, for instructors to assess each student's knowledge of the information covered in the lectures and readings. However, any instructor who relies on a teaching approach based solely on a passive text-lecture-exam format runs the risk of driving student motivation and interest even lower. Many instructors realize this risk and include active-learning experiences in their research methods courses. Arguably the most popular active-learning experience in research methods courses is a student-developed research project (Marek, Christopher, & Walker, 2004).

Student-developed research projects involve original research conducted by a single student or a small group of students. Research projects provide a wonderful active-learning experience that students typically embrace with increased motivation and interest. Students learn first-hand the challenges of reviewing the relevant research literature when formulating research hypotheses. Reading scientific research is much more purposeful when students direct this reading towards their own specific research goals and objectives. Students design their own studies and must make many challenging methodological decisions. These methodological decisions are more meaningful to the students as the consequences of their decisions are experienced first-hand rather than simply read from a textbook. Students use statistical analysis as a tool for turning raw data into answers for research questions the students themselves have formulated. The resulting findings are much more meaningful to the student than sample problems taken from a statistics text. Students gain valuable experience

presenting research while getting immediate and specific feedback about their research efforts. Presenting research findings is much easier and more relevant when the student has been involved in each stage of the research process.

During the past five years, we have piloted a research methods course for undergraduate psychology students based solely on student-developed projects. Recent developments in teaching practices and information technologies have helped make this type of course both feasible and effective.

Recent Teaching and Information Technology Innovations

Problem-based learning (PBL) is a global teaching phenomenon that is changing the way many higher-education teaching faculty and administrators are approaching the teaching of undergraduate and graduate courses (Barrows & Tamblyn, 1980; Boud & Feletti, 1997; Duch, Groh, & Allen, 2001; Evensen & Hmelo, 2000; Savin-Baden & Major, 2004). This approach was first used on a large scale in the teaching of medical students in North America during the 1960s and 70s, and has now evolved into a general teaching ideology or framework (Savin-Baden & Major, 2004). The PBL approach to teaching builds on the active-learning pedagogy promoted by education researchers and has many commonalties with the experiential-learning developments seen in professional and career training programs. PBL has been successfully adapted to nearly the full range of subject areas offered in higher education, regardless of whether the subject matter pertains from the natural sciences, social sciences, or humanities. Originally, the PBL approach was developed for professional training courses, but the same general approach can be adapted to small theoretical classes and even large introductory classes (Duch, Groh, & Allen, 2001). New PBL courses are emerging around the world and whole institutions are working on the development of PBL based curriculums (Duch, Groh, & Allen, 2001; Savin-Baden & Major, 2004).

The main goals of a PBL course are (1) to encourage self-directed learning in the students that leads to higher motivation, better retention of material, and the development of important reasoning and problem-solving skills, and (2) to develop a better understanding in students of the group processes and skills necessary for successful working collaborations. As the goals of PBL have much in common with the goals we have for teaching research methods to undergraduate psychology students, many of the guidelines and innovations we have used in developing our course come from the PBL literature. A PBL course consists of the following general attributes: (1) students work in small groups on solving a problem, (2) the groups are encouraged to work as collaborative teams, and (3) the instructor facilitates the problem-solving process without specifically directing the process (i.e., learning is student-centered not instructor-centered).

Although we found PBL to be an exciting teaching foundation on which to base the design of our research methods course, the time and resource constraints of completing multiple student-developed research projects in a 15-week long class still existed. Fortunately, recent information technology developments have considerably eroded these constraints. High-speed Internet access now provides students with instant access to research resources and enhanced communication capabilities. On-line literature search engines allow researchers to conduct comprehensive literature reviews within seconds, and many of the target articles can now be accessed immediately via on-line journals. Even interlibrary loan requests for target articles now take only a few days to process with the use of new scanning and communication technologies. The Internet provides students with ready access to free experimental stimuli (e.g., pictures, sounds, etc.) and software tools for creating, manipulating, and presenting stimuli. The Internet can also present and deliver questionnaires, and free online survey sites exist. Students can communicate and share files with each other using Internet technology, and the same technology facilitates communication and feedback between the students and instructor. Our research methods course would not be possible without student access to these wonderful new technologies.

Class Organization

The first author teaches a research methods class to undergraduate psychology students each semester during the academic year. The class schedule consists of three 80-minute classes a week during a 15-week semester. The students are typically in their second year of undergraduate studies and take a research methods course to fulfill a requirement for graduating with a psychology major. Many education and neuroscience majors also complete this course as part of their degree requirements. The class has a maximum enrolment of 40 students and this is usually the number of students that enrolls each semester.

The instructor randomly assigns students to small groups of five students, and each group designs and conducts an original piece of research. PBL researchers suggest that groups of five to seven students are optimal for this teaching approach (Bruffet, 1999; Duch, Groh, & Allen, 2001). The majority of class time is taken up with group discussion, and the instructors act as "floating facilitators" -- moving from one group to the

next asking questions and assisting students in their understanding of the research problem requirements Sadin-Baden (2003) provides a helpful discussion on how faculty can facilitate this shift from being a lecturer to being a facilitator.

Throughout the semester, groups will work on three different research projects with group membership changing from one project to the next. This allows five weeks to design each study, collect the data, analyze the data, and present the findings. Eventually each group presents its research findings in class with a 20-minute oral presentation in a simulated conference session or with a poster in a simulated poster session. Students are then required to submit an individually written report of their group's research findings using the guidelines of the American Psychological Association. The instructor does not assign a specific textbook to the class although he does provide students with a list of recommended introductory texts in research methods that are optional texts for the course. Students are encouraged to purchase the latest edition of the American Psychological Association's publication manual to assist them with the completion of the written requirements of the class. Two graduate-student teaching assistants help facilitate group discussions and provide marking assistance.

Selection of Research Problems

The instructor assigns all groups of students the same general research problem and Table 1 lists some examples of research problems used in previous classes. Each research problem is matched to a methodology so that all groups incorporate the same methodology in the research they conduct (refer to Table 1). Without doubt, the selection of interesting and stimulating research problems for this class is one of the most challenging and important tasks for the instructor to accomplish, as is arguably the case for all PBL courses (Maufette, Kandlbinder, and Soucisse, 2004). Although changing the research problems from one semester to the next provides a creative challenge for the instructors, it also guarantees new and interesting teaching experiences each semester.

As can be clearly seen from Table 1, the authors favor research problems that relate to psychological differences between the genders. There are two reasons for this preference: (1) the study of gender differences is an area of psychology that has a long and strong empirical tradition that is growing in theoretical importance with the recent emergence of evolutionary psychology theories, and (2) gender differences are usually of particular interest and relevance to the undergraduate students who make up our classes. Table 1 also provides some examples of student projects that have resulted from these general research problems. Students embrace the opportunity to conduct research on interesting and topical questions, and the ownership of the research endeavor is strongly based with the students.

Facilitating Collaborative Student Teams

For this approach to teaching research methods to work successfully, it is vital that each group of students works efficiently as a collaborative team. As few students come to higher education with extensive experience working in collaborative learning groups, it is usually necessary to provide students with some basic information and guidance on group processes and effective team performance. We have found the Internet site maintained by the Derek Bok Center for Teaching and Learning at Harvard University to provide an excellent guide on how to build students' skills in group processes. In addition, most PBL texts cover this important topic, and we have found the discussion by Savin-Baden and Major (2004) to be very helpful.

We begin our course with class instruction on group processes that lead to cohesive team collaboration. The class focuses on group roles, leadership, communication skills, and conflict resolution. We incorporate this information into short role-playing exercises to provide students with opportunities to practice these skills in a non-threatening environment. This introduction helps to prepare students for the drastic change they may experience when moving from the more familiar and comfortable text-lecture-exam format to a group-project format. This change in teaching format is stressful for some students (Solomon & Finch, 1998) and instructors must provide outlets for students to air or resolve worries as they arise (Savin-Baden & Major, 2004). The role-playing exercises provide one such outlet, as do open communication channels between the instructors and students. Fortunately, the PBL approach to teaching facilitates communication between students and instructors by the use of small group discussions.

Peer Assessment

A fundamental goal of the class is to encourage consistent and optimal involvement of every student in each group project. One method that proponents of the PBL approach recommend to achieve this goal requires students to provide peer assessments of their fellow group members. Peer assessment purportedly rewards students who play a significant role in the group project and encourages others to assist in the project development as much as possible. We keep each group member's peer assessments confidential, and provide each student with the mean score of the assessments from their group. Empirical research

TABLE 1
Some Research Problems Provided to Students and Examples of Student Projects Generated for Each Problem. The Suggested Research Methodology to be Used by Each Student Group Is Also Provided.

Gender differences in same-sex best friendships (Case study)
Gender differences in conflict resolution by best friends
Gender differences in communication between best friends
Gender differences in the role of intimacy in best friendships
Portrayal of gender roles in the media (Observational/archival)
Stereotype portrayal of gender roles during infomercials
Gender differences in body portrayal in popular magazine covers
Gender differences in the coverage of elite athletes in the print media
Gender differences in stress and coping (Survey)
Gender differences in eating habits when stressed
Gender differences in the use of exercise when coping with stress
Wanting to have children and a career: Gender differences in role conflict
Gender differences in spatial abilities (Experimental)
Gender differences in spatial memory: Real world objects versus abstract figures
Gender differences in judging distances
Gender differences in the use of landmarks when navigating

appears to support peer assessment as a valid indicator of each individual's contribution to the group project (Ledman, 2003; Topping, 2001). However, we also supplement peer assessment with an equally weighted instructor assessment of each group's presentation.

Five Phases of Student-group Research Projects

For each of the three research projects conducted during the semester, activities generally follow the same five basic phases or steps of the research process. This allows roughly one week to be allocated to each phase, although this allocation of time may vary slightly for different research methodologies. Furthermore, the number of student group meetings held outside of class time without instructors present will vary from one phase to the next.

Phase 1: Research question generation. During the first phase, the instructor introduces the general research problem and each student group brainstorms some specific research questions for their group to investigate. The instructors facilitate this brainstorming process in classroom discussions and then the students refine their ideas by reviewing the relevant research literature out of class. Research questions resulting from these collaborative group discussions are typically of a high standard and very rarely overlap. Even if there is some overlap between groups, the commonalities and differences that arise can actually enhance later student discussions of each group's findings.

Phase 2: Research design. Once each group has chosen a research question that is approved by the instructor, the research design phase begins. Students review the relevant literature again, but now focus their reading on the methodologies used in published research. It is important during the research design phase that the instructor interacts frequently with each small group to facilitate and guide key design considerations and decisions. Sometimes it is more efficient for the instructors to provide formal instruction to the whole class in the form of a 10-15 minute mini-lecture on specific methodology aspects that all groups need to consider in their designs, such as, interview techniques or questionnaire development. At the end of the research design phase, each group submits a formal ethics proposal to the instructor for approval.

Phase 3: Data collection. The type of activities involved in the data collection phase varies considerably from one research methodology to the next. The data could come from the coding of archival sources such as magazine covers or Internet sites. But many times, human respondents or participants are required. These participants are typically recruited from friends, family members, and classmates of the students. Due to the time restrictions usually imposed on data collection, email versions of questionnaires are preferred and group data collection is encouraged. Once collected, data are coded, collated, and entered into a data file for statistical analysis. The data collection phase is often the most time consuming and demanding phase of the project and each group member needs to take an equal share of the load.

Phase 4: Data analysis. The data analysis phase generally requires much more instructor guidance than any of the other phases. Each group spends class time alone with the instructor preparing the data file for analysis, discussing the statistical analyses required, conducting the appropriate statistical tests, and interpreting the resulting findings. Due to the inexperience of the students with such analyses, in addition to the importance of the accuracy of the

findings, the instructor provides a major role in this process for each group. It is very important that the instructor is confident that all group members understand their findings, or lack of findings, before they are allowed to continue with the final phase of the research project.

Phase 5:Research presentation. The instructor provides some formal instruction to the whole class on presentation techniques and requirements, such as, APA publication style, scientific writing, PowerPoint slide layout, talk organization, and oral presentation skills. Two members from each group present their group's research in a 20-minute oral presentation to the entire class. The group presentations are organized and delivered as a simulated conference session. Each presentation is followed by a 10-minute open discussion period with the instructor acting as the chair of the conference session. Following the group presentations, each group member independently writes up their group's findings as an APA-style report that is assessed by an instructor.

Student Evaluations of the Course

Student evaluations from two group-project classes (n = 52) and two traditional lecture classes (n = 45) taught by the first author were compared. The research methods classes were matched on class size and semester taken. Table 2 presents the mean student evaluations obtained and highlights the superior evaluations reported for the group-project classes on all measures. Despite the heavy workload of the group-project class, students clearly perceived the course as an excellent learning experience. It was especially pleasing for us to see how much the group-project classes increased the students' interest in doing research.

Students from the group-project classes (n = 35) also completed a brief survey on specific aspects of this non-traditional teaching approach. The majority of respondents (82.4%) did not have prior experience with a class that involved working in small groups. Students reported that they did not miss the traditional use of exams (91.4%) or an assigned textbook (88.6%), and all students reported feeling adequately prepared to conduct research in the future. In fact, many students (75.8%) reported that they felt very well prepared. Very few students (2.9%) perceived the workload associated with the student-projects as less than other classes for the same amount of class credit, and many students (51.4%) felt that the group projects involved more work. Many students (51.4%) reported that working in small groups was a very positive experience, but some students (40.0%) reported that working in groups presented both positive aspects (e.g., useful and interesting) as well as negative aspects (e.g., frustrating and challenging). Students' attitudes towards peer assessment were overwhelming positive (86%). Of course, caution should be applied when evaluating student ratings of courses, especially when not all members of the class responded to the survey.

Strengths and Weaknesses of Learning Research Methods by Doing Research

Although student evaluations of our course is consistently positive, we accept that many research methods instructors will be concerned that the full range of methodologies and terminology found in

TABLE 2
A Comparison of Student Evaluations for PBL Research Methods Classes and Traditional Research Methods Classes

	PBL class		Traditional class		
Evaluation question	*M*	*SD*	*M*	*SD*	*t*
Quality of class discussion	4.49	0.62	4.00	0.57	4.030***
Course stimulated interest	4.48	0.81	3.48	0.74	6.310***
What was learned	4.39	0.88	3.74	0.63	4.123***
Rate course overall	4.55	0.54	4.04	0.59	4.444***

Note. Course evaluations are based on a five-point scale ranging from 1 (*very poor*) to 5 (*excellent*). Independent-samples t-tests (df = 95) compared scores from students who received student-project instruction with scores from students who received traditional lecture-text instruction.
***p<.001

contemporary research methods texts cannot be covered by this non-traditional approach to teaching research methods. Similar criticisms are often leveled at PBL courses, but research comparing traditional lecture-based courses with PBL courses has not generally found a significant difference in the content coverage of the courses (Shahabudin, 1987) or in the students' final knowledge of the topic (Antepohl & Herzig, 1999). Furthermore, research with medical students has found that students who received PBL training have fared quite well in later professional examinations and evaluations when compared with graduates from other traditionally taught medical programs (Antepol, Domeij, Forsberg & Luvigsson, 2003; Enarson & Cariaga-Lo, 2001).

Clearly, there are also some research methodologies that are not suited to student-developed projects that need to be completed in a few weeks. For example, longitudinal studies cannot be really considered for such short time periods. Availability to specific research resources may also rule out other types of methods. Developmental studies cannot be considered without access to young children as participants, and that access would be difficult to secure.

Our personal feeling is that traditionally-taught lecture courses definitely offer the possibility for a wider coverage of material, but that the group-project approach ensures a deeper understanding of the research process. We believe that learning to do research and to critically evaluate research practices are better facilitated by training critical research problem-solving and reasoning skills than by having students memorize research terms and definitions. We perceive hands-on experience in using a selection of the research tools currently available to social scientists as more important than reading about them in a book. We also believe in the critical value of teaching students to work collaboratively in groups. We believe so strongly in these points that supplementing a lecture-based course with a single student project does not fully achieve these goals. Of course, empirical research that tests the quality of research products provided by graduates from both types of methods courses would help to support these claims, and hopefully we can conduct such comparisons in the near future.

A number of pragmatic difficulties may exist for instructors trying to implement a course relying solely on student-based research projects at their institution. We are very fortunate to work at a university that provides students with wireless computer access to state-of-the-art information technology. Our course would be very difficult to teach at an institution without such research technology tools given the time frame imposed by the class duration. Some possible compromises to introducing this style of course may need to be implemented by faculty at institutions that do not provide this information technology. For example, faculty could decrease the number of projects attempted in the class or limit the scope of the final research product to a research proposal.

Some critics of the group project approach may raise concerns regarding the instructor's ability to adequately oversee and supervise eight student research projects at one time. We have certainly found this is a challenging task but quite feasible if the class remains student-centered throughout the semester. We are also fortunate to have control over class size and this helps us to keep the number of groups and group sizes to manageable numbers. This control may not be possible for some instructors who are faced with much larger class numbers. Some PBL authors recommend the use of peer tutors to overcome the demands on the instructor that a larger class can entail (Duch, Groh & Allen, 2001). In our case, these peer tutors would come from past graduates of the research methods class. However, we have not used peer tutors in our class and are concerned that these tutors would not have the necessary research experience to fulfill such a role. We hope to pilot a peer tutor system in a future research methods class to further examine this option.

Our university does not require ethical approval for undergraduate student research projects that are not going to be published. However, other institutions may have stricter IRB requirements. Such requirements could make it very difficult to conduct the student projects in the time provided. The fact that student projects are spread across the semester will help avoid the usual mid-semester glut of ethics reviews. Furthermore, we have often set projects that do not require human participation ethics approval, such as, evaluating media output or conducting naturalistic observational research (refer to Table 1 for some examples of such research projects). Faculty at other institutions could increase the number of these research projects to lessen the time burden imposed by stricter ethics requirements practiced at their institution

The use of peer assessments may also concern instructors who prefer more control of their class assessment. We believe that peer assessments do encourage better group participation and provide a good source of feedback for students, but we also recognize this method of assessment is still reasonably untested. For example, we are not sure how to use the peer assessments received from a group member who contributed little to the group

project and missed many group discussions -- should their assessments still be included? Would including self-assessments increase the validity of the resulting peer assessment scores? We are also experimenting with the relative weightings of peer and instructor assessment to optimize the fairness and validity of the final assessment. More research is definitely needed on the use of peer assessment in undergraduate courses that require group projects.

Summary

We believe that requiring undergraduate students to participate in group-based research projects throughout a semester is an excellent way to teach research methodology. This approach incorporates recent pedagogical and technological innovations and students respond well to the challenges posed by such a class format. We have also found this teaching format to be more interesting and stimulating to teach than the traditional lecture-text format. The class may not suit all instructors, especially those who favor a guaranteed coverage of a wide content or those who have restricted resources for student research. Finally, further research is required to compare the research products of students who have completed a group-project course with those who have completed a more traditional lecture-text course.

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