Rolling in the Deep: Assessing Higher Cognitive Skills in the Context of an Undergraduate Research Course

Summary of Original Proposal

Carol Hostetter, Sabrina Williamson Sullenberger and Leila Wood (School of Social Work)

This mixed-method research will study the effectiveness of engaging undergraduates in an authentic research project within the context of an introductory research methods course. With an emphasis on team-based learning, this two-year-long project will develop a tool to assess students’ use of higher-order cognitive skills. Goals for the project are to increase both undergraduates’ engagement in learning about research methods and to actively involve undergraduates in IRB-approved research projects. Assessment of students’ critical thinking skills will occur via multiple forms, including focus groups and pre-test and post-test measures of students’ knowledge. From this assessment the researchers will develop and test an assessment tool that can be used in multiple disciplines and professional schools as a measure of the development of critical thinking skills.

Submitted Final Report

Date of Award: Fall 2012
Type of Award: Phase III
Total undergraduate students: 100
Total graduate students: None

Executive Summary

Students’ grades were high, their perceptions of the course at midterm and the end of the semester were predominantly positive, and their final reflection showed that the large majority (86%) thought the course design helped them improve their research knowledge and skills. A focus group of students in the following year showed that they felt they improved their research knowledge and skills, and they also felt proud to know that social work makes a strong contribution to the knowledge base. Pre- and post-tests of knowledge for two
semesters of students showed a statistically significant increase in their knowledge from the first week to the final week of the semester.

**Budget Narrative**

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**Report Narrative**

*What were the most significant findings of your study?*
It’s significant to know that students’ knowledge increased from an “F” to a “C” with Team-Based Learning and conducting authentic research projects.

*Were there unexpected findings? What surprised you?*
Students’ pride in our field surprised me. They didn’t realize that social work is an actual science that contributes to the knowledge base.

**Reflection on the Process**

*How did the study differ from what you proposed?*
I have not been able to figure out how to measure the cognitive development. I’m still working on this. *What methodological approaches did you use?*
I used both quantitative and qualitative.

*What methodological challenges did you encounter?*
This was a huge issue! I arranged focus group interviews, run by my colleagues, and students didn’t provide good information. There was a little,
but there were MANY comments of “I agree with what she said.” That was disappointing.

**Connections to Field and Distributing the Findings**

*What changes were made in the classroom based upon those findings?*
I have used the data to teach students about previous classes, which helps reassure, inspire and motivate them.

*What existing or emerging work does this study connect with?*
The Council on Undergraduate Research is something my work connects with. There are also other current SOTL grants at IU on similar questions, and I have emailed those faculty to connect.

*In what ways have you already disseminated the results?*
We have one publication and three presentations:

- Assessing higher cognitive skills in undergraduate learning (with Leah Savion), International Society for the Scholarship of Teaching and Learning, October 2013
- Metacognitive skills for critical transitions in learning, International Society for the Scholarship of Teaching and Learning, October 2013
- “Experience is the key to learning”: Engaging Students through Project-Based Learning, International Society for the Scholarship of Teaching and Learning, October 2012

*What plans do you have to further this work?*
I need to find a good measure of cognitive development, and also get my department to consider a pre-post-test from the beginning of our program to the end of our program.
ROLLING IN THE DEEP: ASSESSING HIGHER COGNITIVE SKILLS IN THE CONTEXT OF AN UNDERGRADUATE RESEARCH COURSE

FACT SHEET

RESEARCH PLAN:

NAMES OF INVESTIGATORS:

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FUNDING LEVEL REQUESTED: Phase III

PROJECT TIMELINE: Fall 2012 to Spring 2014
1. Purpose of the investigation with specific research objectives

SOTL practices encourage teachers to turn a lens to our classrooms, using theories and methods from the literature to solve classroom problems. Three concerns motivate this classroom intervention: 1) a lack of student engagement in an undergraduate research class, 2) the importance of involving undergraduates in conducting research projects, and 3) the need to assess levels of student learning. We propose to intervene in an undergraduate research class with deeply structured and scaffolded methods, and to study the effectiveness of the intervention through a mixed-methods approach. Through the project, we will develop an assessment tool, designed to assess students’ use of higher-order cognitive skills. The project will culminate in a website and networking with other interested faculty, along with more traditional dissemination routes.

Lack of Student Interest

One common problem in our field is the lack of student engagement in required research courses. One investigator was dismayed to read in her end-of-semester evaluations, “I never read the textbook.” This does not seem to be true for her research class alone. As Maschi and associates (2007) report, “more than two decades of literature suggests that social work students often experience negative emotional, cognitive, or behavioral responses to research coursework, particularly during the initial learning stages” (2007, p. 2). We believe this challenge extends beyond the social work profession to other professional schools and disciplines (Stanford and Shattell, 2010), making the project on this shared classroom problem ripe for assessment and dissemination.

The Importance of Involving Undergraduates in Research

Increasingly, evidence is emerging to show that engaging undergraduate students in authentic research projects with faculty members has many benefits for learning. Kuh and associates recommend that undergraduates be given opportunities to engage in research with faculty; they contend that those who do have increased chances of graduating as well as gaining more intellectual and personal benefits (Kuh, Kinzie, Buckley, Bridges, & Hyek, 2007). The Council on Undergraduate Research (CUR) defines undergraduate research as “an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline” (CUR, 2012). CUR asserts that undergraduate engagement with research increases retention and helps students develop critical thinking skills and enhance understanding of research methodology (CUR, 2012). Given the possible benefits of having undergraduate students participate in research projects, we seek to discover more about teaching methods which promote more interaction, engagement and interest.

The Need to Assess Levels of Undergraduate Learning

College learning should be more than having students acquire sets of facts. The arc of cognitive development from the first year through the last should reach the level of deep learning, the growth of moving from memorizing to analyzing, synthesizing, and applying learning to new situations (Craig Nelson, SOTL address, fall 2011). SOTL scholars have produced taxonomies which could prove to be useful in this context: 1) Perry’s scheme of intellectual and ethical development, 2) King and Kitchener’s notion of reflective judgment, and 3) Biggs and Collis’ SOLO taxonomy (Structure of the Observed Learning Outcomes). These three models, connected with work such as Dewey, Bloom, and Baxter Magolda, appear to provide the best possibilities for a fruitful assessment tool. Our goal is to develop and test an assessment tool that will be useful for faculty in a variety of disciplines and professional schools.
The Intervention

We address the challenges of involving undergraduates in research through an intervention which combines several teaching methods. The pedagogical foundation of the course is Team-Based Learning (TBL). TBL is an active learning method which includes a specified classroom structure and experiential component. TBL supports content coverage through a team approach, frequent testing on class readings, group and class discussion, and application of knowledge (Michaelsen and Sweet, 2008). Research on TBL found students are more accountable and are more likely to learn valuable team-work skills with TBL than in a traditional classroom (Michaelsen and Sweet, 2008). The heart of the course is conducting an IRB-approved research study. The course objectives rest primarily on two goals, understanding research methods and demonstrating research skills. At the ISSOTL conference in 2005, Keith Trigwell quoted Yogi Berra, saying, “In theory, there is no difference between theory and practice. In practice, there is.” This statement illustrates research that links active learning with student engagement and learning. Komarraju and Karau (2008) found student engagement to be positively correlated with in-class activities, and suggest using a variety of teaching techniques to help students of all motivational and engagement levels learn. Finally, the course is delivered through a series of carefully-scaffolded activities which guide students in the conduct of their research projects.

Research Methods

The purpose of this investigation is to analyze the impact of engaging undergraduates in an authentic research project, using TBL as the primary teaching method. Evaluating the teaching intervention is essential. First, we must understand whether the intervention works. Next, as Kathleen McKinney said at the Indiana University SOTL Series program (and published in McKinney, 2012), in reference to SOTL interventions, “We need to understand how the intervention works, and why it works.” Therefore we ask the following research questions in this project:

1. Does engaging undergraduates in a research project, using Team-Based Learning, increase student satisfaction and feelings of interest in an undergraduate research class?
2. Does engaging undergraduates in a research project, using Team-Based Learning, help them understand research methods and demonstrate research skills?
3. If the first two questions are answered in the affirmative, how and why does this happen?
4. What level of cognitive skills do students who have completed a project-based and team-based research class exhibit?

The following quantitative and qualitative methods will be used to answer the research questions:

- Use pre- and post-tests to measure whether students gained knowledge of the research process, in two cohorts of social work juniors taking an introductory research course in the school years 2012-2013 and 2013-2014.
- Use reflective teaching methods to collect and analyze students’ reflective writing on their Team-Based Learning experience and their conducting a research study.
- Conduct focus groups with students after they have taken the course.
- Examine grades from Team-Based Learning tests and research project papers to assess whether students achieved a high level of research knowledge and skills.
- Use an assessment of students’ cognitive skills.
2. Previous research results

Both of the investigators of this research project have undertaken and published SOTL research in the past. In a pilot project related to the proposed study, Dr. Hostetter has recently begun to evaluate the impact of engaging social work students in a research project. Students in an undergraduate social work research class were taught using TBL. Students were divided into teams responsible for completion of small research projects, while the entire class conducted interviews on the same topic. Students took unit tests based on assigned readings, discussed the readings and the test both with their team and with the class at large, and applied their research knowledge in scaffolded assignments that built towards the final product. The team approach allowed for close mentoring and feedback as each task was completed. Teams presented their findings through a poster session and team papers. Student learning and attitudes were evaluated using multiple measures including testing, student reflection papers, and final papers. Quantitatively, the effectiveness of the TBL method was measured on tests and papers. Qualitatively, measures included reflection papers and course evaluations. Students participated in a research project with Dr. Hostetter about adolescent constructions of poverty, an area of interest in social work studies. Students completed testing for IRB certification, and conducted and transcribed 47 interviews.

This instructional method was found to provide evidence of attained knowledge and feelings of engagement. Students' scores on knowledge tests averaged 90% or better. Student reflections were strongly positive as to their perceptions of their learning and interest in the course. In addition, this method was found to improve the classroom environment. Students arrived prepared for class, the energy was high, and students were engaged. One aspect students particularly appreciated was that the research project they conducted had been approved by the institution's IRB, so it was "real" research and could be published. Examples of typical comments were: "You have to be prepared for class or it is just awkward," "I love having multiple opportunities to apply what we're learning," and "I learned a lot about research by having to do it for our projects." Results of the previous study were presented at the Indiana University Bloomington Scholarship of Teaching and Learning Conference, 2011, the ISSOTL conference, 2011, and the Annual Program Meeting of the Council on Social Work Education, 2011. The current study extends this work by several means. One, it uses a knowledge pre- and post-test, key to understanding whether the students actually learned course concepts that they did not know when beginning the course. Two, it uses focus groups to discover deeply nuanced feedback from students on the “how” and the “why” questions. Three, it more tightly constructs the course delivery of Team-Based Learning and scaffolded assignments, which is essential for the planned dissemination of the teaching method. Four, it develops an assessment tool to measure levels of cognitive skills students exhibit.

3. Significance and impact the study may have upon teaching and learning and the assessment

This study will use both quantitative and qualitative methods to assess the impact of research engagement on student learning. Using a mixed-methods approach will allow us to gain insights about the potential impact of the instructional method on undergraduate students’ learning outcomes and attitudes, and additionally, how and why it might work.

This study will provide important insights that extend beyond social work and into other fields of social and natural sciences. By providing a template for how undergraduates can be
engaged in an authentic IRB-certified research project, other disciplines can modify the instructional methods to their own fields. Cooley et al. (2008) insisted that it is a win-win for faculty and students when faculty members engage undergraduates on their own research projects. Students learn skills and received credit, and faculty are able to prepare data for potential manuscripts and presentations without the added time stress of an additional project.

An additional aspect of the project will be videotaped classroom activities and student interviews. The investigators have valued similar videotapes from Larry Michaelson’s Team-Based Learning project (classroom activities) and other projects which provide interviews with students. Videotapes can portray energy and enthusiasm better than text. With the resources available at Indiana University, we can provide brief video clips to put on our website to disseminate the results and encourage adoption of the pedagogical methods.

4. Outcomes from the work and contributions to the assessment of student learning

Dr. Hostetter began using the combination of TBL and the research project spring 2011 in the introductory research course in social work. Student reflective writings illustrated that the method of teaching was helpful to learning research skills, which she has taught for many years. 85% of students in the 2011 cohort felt that TBL and the research projects helped them learn to critically evaluate research and emphasized the importance of experiential methods to learning. The current research proposal allows the evaluation to go to the next level by adding a pre and post test design, focus groups, and a cognitive skill assessment tool for use in other departments at Indiana University. This will enhance student learning not just in social work, but in the larger SOTL community at IU. In addition, conference presentations, an online workbook and wiki on course design for undergraduate research engagement, and manuscript submissions will further the dissemination of knowledge to other faculty members at Indiana University.

5. Research methodology, including data collection and analysis

The method will involved a pre and posttest design, conducted with the research class of social work juniors, in the spring of 2013. The instrument will be given at the start of the first class and again on the last day of class. A paired sample t-test will help to analyze differences at pre and post test. The focus groups will be conducted twice, once in the fall of 2012 with students who took the course in the previous spring, and again in the fall of 2013 with the second cohort of students. The focus groups will be conducted by Dr. Sullenberger and a graduate assistant to minimize possible student discomfort about answering questions related to a course in front of the instructor. The focus groups will be conducted in small groups of 5-8 and the data will be analyzed using the grounded theory method. Grounded theory helps the researcher to develop a systematic method to find emerging theory in a data set (Strauss & Corbin, 1998). Rather than imposing a hypothesis on the data, inductive methods help to create a theory from data on a given phenomenon (Strauss & Corbin, 1998). Grounded theory will be employed to understand how and why the course design, including TBL and the research project, did or did not enhance student engagement in research and course objectives. Finally, we will develop a measure of higher cognitive skills, based on SOTL literature. The measure will be piloted in the spring of 2012 and utilized in the spring of 2013.

6. Means by which you will measure the success of the project
The success of the project will be measured by student scores at posttest, data from students’ reflective writing, data from the focus groups, students’ grades on tests and papers, and data from the assessment tool. The project will be considered successful if it helps the majority of students master the course objectives and contributes information about undergraduate research engagement and higher cognitive skills to broader communities of faculty. Other signs of success would be having other faculty visit our website, watch the videos, download the workbook, and participate in the wiki (see below).

7. **Manner in which results will be disseminated**

The results will be disseminated in several ways. First, an online workbook will be developed to use as a model for other faculty teaching research to undergraduate students. This workbook will be available on the Indiana University School of Social Work Website and possibly other websites too. We will also set up a wiki on the website for other faculty to provide feedback and further hone the workbook and methods. We will post the videos of classes in action as well as student interviews about their experiences in the class on the website as well. The use of an accessible website will help the research team provide evidence as to whether or not our work contributes to the field and adds to the knowledge base (as specified by the goals of Phase 2 and Phase 3 for this grant).

Second, the investigators will submit proposals to present findings at the CUR and ISSOTL conferences in 2013, as well as a social work conference. Both investigators have made numerous presentations at national conferences in past years. In addition to presenting papers, the investigators will participate during the conferences in working groups devoted to teaching research.

Third, the investigators will submit manuscripts to multidisciplinary teaching journals and journals dedicated to teaching in social work. The principal investigators have published in these journals previously.

8. **Reflective teaching practice**

Reflective teaching processes are built into several aspects of this project. The first is the use of pre and posttests. This will help the research team to reflect on what students already knew, and what was new knowledge from the course. Student mid-semester and final course evaluations, along with students’ reflective writings, also help to reflect on student learning and instructional practice. Perhaps the most useful practice is the assessment of students’ cognitive skills. An accurate assessment of students’ cognitive skills will provide investigators with understanding of students’ ability to carry out higher order cognitive skills of synthesis and analysis. Students who have engaged in a research study will have had the opportunity to implement knowledge and skills learned in not only the research class, but in other courses prior (intensive writing, mathematical modeling, etc.) The investigators hope to use this measure as a comparison tool in future projects. Much like the NSSE, an assessment of students’ cognitive skills can be used in different departments, on different campuses of the same department, and in a variety of ways to evaluate the levels of intellectual growth students have gained. As mentioned above, the investigators were motivated by reflecting on past comments in student course evaluations which indicated a lack of textbook reading for this course. We will examine future evaluations in the hopes that students do not write, “I never read the textbook.”


SUPPORTING DOCUMENTS

REFERENCES


**BUDGET REQUEST AND NARRATIVE**

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*Budget explanation*

Hiring a doctoral student to aid in the research project tasks is essential for the successful completion of the project. In social work, we have many doctoral students who are skilled in both qualitative and quantitative methodology. We would like to hire a student as a graduate assistant in the fall, which costs $7000 for the stipend and benefits. In the spring and summer of 2013, we would need the student for less time. Having the student work 10 hours a week for 20 weeks would meet our needs well. In the fall of 2013, the student would aid us in presenting papers at national conferences. While some funding may be available for our students’ travel expenses, it would be helpful for the student to have a travel stipend of $1000.
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<tr>
<th><strong>Research Plan and Timeline</strong></th>
<th><strong>Year One Timeline</strong></th>
<th><strong>Summer 2013 Objectives</strong></th>
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<td>Submit for IRB approval</td>
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<td>Conduct focus groups for students in Spring 2012 research class</td>
<td>Use pre- and post-tests of knowledge, cognitive skills assessment tool and reflective writing exercises</td>
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<td>Edit brief videos from focus groups</td>
<td>Videotape student interaction in classroom</td>
<td>Analyze cognitive skills assessment tool</td>
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<td>Refine course based on prior feedback, improve scaffolded assignments</td>
<td>Submit proposals for dissemination at conferences</td>
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<td><strong>Prepare video recordings, workbook, and wiki for website</strong></td>
<td><strong>Conduct course with same research protocol as articulated above</strong></td>
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<td><strong>Disseminate at conferences through papers and presentations to teaching research work groups</strong></td>
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