Theory Practice Service Learning in a Statistics Class

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Abstract

Students actively working together on a class service project involving the collection and analysis of data have been part of the Introduction to Probability and Statistics course (calculus-based) at Oxford College of Emory University for the past five years. Each class project was in response to the need to know information from the student body such as students' perceptions regarding the Honor Code or questions students would like to be asked on a course/instructor evaluation form. The instructor provides the general question for the class to consider and outlines the components necessary to arrive at a finished report. After selecting a leader and secretary, students design and pilot an instrument for gathering data, obtain and collect data from a random sample of 10% of the student body (n = 50 to 60 Oxford College students), evaluate data, prepare a final report that summarizes the class finding, and present the report to the appropriate audience. Students have the opportunity to work as a class (between 10 and 22 students) and in smaller groups, gathering and analyzing real data as a service project to the college. Since Oxford College is a residential school, the return rate has been at least 90%, even discounting surveys that are non-responsive to the task.

What is a Theory Practice Service Learning (TPSL) Project?

Theory Practice Service Learning is an Experiential Education approach that includes, among other things, student involvement in the practical end of what they are learning in the classroom. As such and in the approach used in this statistics class, the positive elements related to collaborative learning, active involvement in learning from and contributing to others' learning, are evident. Outcomes from these projects include the completion of relevant work needed and valued by the college community. In these TPSL class projects, students tackle institutional research questions too large for an individual student to complete over a semester. Projects are motivational while students apply skills learned in statistics and experience interdependence and teamwork. Investigative projects such as those described in this paper seem to stimulate critical thinking in that students must experience thinking classified as analysis, synthesis, and evaluation to complete the project.

The generic components of each class project include: identify research need (question to be answered), determine format for data collection (survey or interview), design instrument, pilot instrument, select random sample, gather data, analyze data, reach conclusions, determine recommendations, write report, and present report to appropriate audience(s).

The Evolution of a Class TPSL Project

The idea for incorporating a class project initially arose from a need in 2003 to obtain information from students in a structured and representative manner, to determine what students knew about technology and what Oxford College should do to assure student competency in technology before graduation. The outcome of undertaking such a task was so successful that the completion of a TPSL project has become a major component in our Math 207 statistics class. Because of the open-ended investigative nature of these projects, much problem solving, both individual and group, occurred through trial and error during the evolution of each class project. Based upon previous experience, the instructor incorporated better ways to encourage students while providing only the structure and leaving students in control.

The Math 207 statistics class is an ideal venue for this pedagogy because students enrolled must have completed calculus II since calculus is used in the theory component. These students are able to learn the material quickly and, for some topics, independently, leaving time for such a project. From the students' point of view, working on the class project has been an invaluable experience. Students in this class do not need prior exposure to statistics.

Summaries of TPSL Projects Completed

There have been five class TPSL Projects:

* *What do Students Know about Technology?* (2003) was in response to determining student literacy and to a movement from a faculty committee for technology across the curriculum. This study also included a survey from the faculty. Comparisons were made between students and faculty members. It was found that students knew much more about technology and uses of technology than the faculty, and that most students were more than literate in the use of computers and software. This helped clarify the technical assistance needed for both faculty and students.

* *What are Students' Expectations of the Advising System?* (2004) was in response to a need for evaluating faculty members as academic advisers. Faculty perception of the duties of an advisor and student perception of the duties of an advisor were found to be different: a mis-communication. In this study, students' expectations were compared to the list of responsibilities given to academic advisers. In response to several discrepancies that were identified, clearer expectations and guidelines were drafted along with the communication of these tasks to both faculty members and students.

* *What are Students' Perceptions of the Oxford College Honor Code?* (2005) determined students' knowledge and attitudes about the Honor Code. After this study, the college instituted a more aggressive educational program for students and faculty. One freshman student from the class became the Chair of the Honor Council for 2006. More about this project is provided in a following section.

* *How do Students View Resources and Support for Mathematics Courses?* (2006) became part of the program review in mathematics mandated by Emory University (all departments must complete a program review in the next few years). Students' attitudes were requested as part of the review, with no venue for obtaining such. The results of this study became part of the program review materials. In addition, Oxford College presently is searching for an on campus person for institutional research so that we do not need to totally rely on resources at the Atlanta campus.

* *Students' Input on the Oxford College Course Evaluation* (2007) was in response to the desire to have an appropriate instrument that would glean reasonable student responses regarding courses and instruction, not just for evaluation, but to provide student input directly to the instructor for the improve of courses. This project is discussed further in a following section.

The Instructor's Role and Student Responsibilities

The instructor discusses experimental design, provides input into the instrument used for collecting data as needed, follows the work of the students and provides guidance to the chairman when and if it seems needed. Communication among students and with the instructor is paramount. The TPSL project's quality and success are up to the work of the students in the class.

<u>The instructor</u>:

* Identifies the need, stated on the syllabus at the beginning of the semester such as appeared on the syllabus for spring, 2007:

The class project will be in the form of a survey or interview, will be designed by the class, and will be related to course evaluations. We will attempt to answer, "What questions would students like asked on the college course evaluation sheet so that responses will include what students consider important for evaluation?"

***** Outlines the components (listed above) and discusses the importance of an appropriate experimental design in obtaining reasonable results.

* Obtains a listing of all full-time enrolled students.

* Schedules necessary class time for discussion of the project and organizing tasks and group work and listens carefully with input only as necessary. Class time devoted to the project is scheduled on the syllabus and is under the leadership of the chairman.

* Communicates frequently with the chairman and secretary as needed.

<u>The class</u>:

* Elects a chairman and a secretary for the project. Within the allotted class time, the chairman determines, with input from class members, what is necessary to complete in class and what can be completed in groups working outside of class. The secretary records the procedure used to complete the project and notes the particular responsibilities of class members. Information is posted on the electronic class sub-conference specifically set up for the project.

* Discusses the project, determines the format (survey or interview) and the design of the instrument needed to collect data.

* Participates in the class conference for the project, a necessary means of communication among the students such as reporting data, listing students needing to be contacted, writing and editing portions of the report, summarizing information from class discussions, and listing individual responsibilities.

* Determines a timeline with deadlines and prepares the final report.

* Prepares an appropriate oral report that may include brochures or power point summaries.

Student Goals Observed through Student Participation in a TPSL Project

It is important that reasons for incorporating a TPSL Project into an already content packed course are clear to both the instructor and to the students involved. These projects take much time and effort on the parts of both instructor and students so that the experience gained from doing such an activity must be valued.

Goals for student participation in a TPSL project are that the students in the class:

* Respond to a need in our college community requiring institutional research, as a service to the college.

* Work and solve problems within the class (group of students from 10 to 22, depending on the year) to complete quality work in a timely manner.

* Determine and design appropriate instruments for collecting data.

* Obtain and seek out a random sample of college students (10% of full-time enrolled Oxford College Students).

* Compile and interpret data (at least 90% "usable" surveys or interviews; some students refuse to answer; some surveys are non-responsive to the task).

* Apply necessary statistical tests.

* Learn to handle problems as they arise in a research setting.

* Write a formal report together as a group and agree on the recommendations and conclusions.

* Present findings to the appropriate audience.

Expectations and the Assignment of Individual Grades

With such an open-ended project, instructor assignment of grades for each individual is difficult. A rubric for grading in this setting does not seem appropriate, especially since such a "check-off" method rarely accounts for variations in quality and/or additional efforts or creativity nor does it account for variations in each year as the project evolves. Therefore, the instructor relies on the following for determining individual grades:

* Student Self Evaluation of Individual Participation (a log of activity, prepared by each student and turned in after project completion),

* Student Evaluation of their Peers (prepared by each student and kept confidential),

* Instructor observations during class discussions and presentations,

* Individual student inputs recorded on the class conference and project sub-conference (available to read). As an example, there were over 400 entries on the project sub-conference during the spring 2007 project, providing an organized location for information as the project evolved and clearly recording inputs from individuals.

Granted, grading student contribution in such a project is somewhat subjective, more so than how students are normally graded in mathematics courses; however, observing these students and their interactions throughout a semester in addition to having an internalized expectation level based on previous projects (past projects are available to the new students) help clarify what would seem an unclear method of grading. The statistics course is based on 1000 points, 200 of which are earmarked for individual participation in and contributions to the class project (or 1/5 of each student's grade).

Example Results Obtained and Future Studies

Two examples, one of an interview format and the other of a survey format are further summarized below.

Interview format example:

For the interview format used with *Students' Perceptions of the Oxford College Honor Code* (2005), the class designed questions to determine if students knew the difference between the Honor Code (academic) and the Conduct Code (student life), and created scenarios to determine if students thought the Honor Codes was effective in controlling cheating. The questions and scenarios were piloted for clarity prior to interviewing students. For each interview, one class member asked clearly defined questions and read scenarios to one of the randomly selected student subjects while one class member recorded results. At the end of the interview process, the selected student was asked to read the recording of his/her answers for clarity and make any adjustments. Using peers to interview and allowing (except for the original random listing of students which is no longer available) anonymity of participants, class members were certain that their results reflected true perceptions of the students.

Results from this study determined that students (and some faculty) needed to be better informed about the Honor Code and that although Honor Code violations were clearly stated, most students would not get involved when aware of a breach of academic integrity. Many students admitted to academically cheating in high school, primarily because there was no code or effort to control cheating, pointing out a real need for educating the college community about the Honor Code. Therefore, the recommendations were in two categories, enforcement and education.

After the faculty received this report, there were two faculty forums to discuss the situation and a re-organization in Honor Council membership to include more faculty members in order to spread responsibility and time involved at hearings. Definite steps have been taken to educate students regarding academic integrity.

Survey format example:

For the survey format used with *Students' Input on the Oxford College Course Evaluation*, the class designed an instrument for students to rank, from a list of possibilities, what was important to be included in a course/instructor evaluation form and the layout or format of the evaluation form. The list included on the survey instrument contained those items presently on the course/instructor evaluation form and those found through class discussions and discussions with other students on campus. After piloting the instrument, some items were eliminated and others were clarified before surveying the random sample of students.

Results indicated that students do not like the bubble scantron type responses and want to make comments in a free response format. This is consistent with what instructors want - constructive comments about the course and the pedagogy. Students deem questions about professors as the most important, followed by course material. Students do not view questions about themselves (study habits or preparation) as important nor do they find a syllabus needed. Based on the results found, the class designed a one-page (front and back) course evaluation form that incorporated all the important questions and features students deemed important.

Copies of the formal report were given to the deans. Brochures summarizing student findings were prepared and sent to every faculty member. The class was thanked by the administration with a promise to incorporate many of the changes in the fall course/instructor evaluation form.

Future topics:

Future topics for TPSL projects seem naturally to emerge in a timely manner. The project completed last year was requested from the administration and presented to the deans with invitations to faculty to attend. Student input into study spaces in our projected new science and mathematics facility is slated for the spring 2008 class to explore, beginning with an originally written case study to elicit class discussions and provide a springboard for realistic considerations.

Conclusion

It is extremely important that faculty members and administrators need or want the information from TPSL student projects and that there is an understanding before such projects are begun. At Oxford College we have clear and amicable communication among faculty, administration, and students, providing the necessary atmosphere for TPSL projects that are needed, valued, and used for educational improvements. Before beginning such a project, students know that the work they are doing is important and will be used.

What students gain from these TPSL projects cannot be totally measured; however, it is clear that such projects give students a clearer picture of what is needed in research and provide an opportunity to explore a unique form of problem solving. Each class has had a real sense of ownership of the class project. In each case, over the past five years, the final written report was an excellent example of quality institutional research as well as clean experimental design, and each was well-received by the appropriate audience.