Journal of Statistics Education

Service-Learning in Introductory Statistics at Kalamazoo College

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Journal of Statistics Education Volume 15, Number 2 (2007),
http://www.amstat.org/publications/jse/v15n2/nordmoe.html

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1. Setting

Kalamazoo College is a selective, liberal arts college located in Kalamazoo, Michigan with total enrollment of approximately 1200 students. The academic calendar is comprised of three 10-week quarters, each of which is followed by one week for final examinations. Kalamazoo College is distinguished by its four-fold academic program known as the "K-Plan": (1) Rigorous liberal arts coursework, (2) study abroad, (3) career development, and (4) the senior individualized project. With the inception of the K-Plan over 40 years ago, experiential education has long characterized the College student experience, especially with respect to the last three components listed above. Over the past ten years, the on-campus experience of Kalamazoo College students has also become more experiential in nature as a substantial proportion of courses now have significant service-learning components.

2. Background

The primary introductory statistics course at Kalamazoo College is Applied Statistics I (Math 260). This course has primarily been taken by students majoring in psychology and the life sciences. Math 260 covers most of the topics in Moore (2003) and employs an activity-based, data rich pedagogical approach with an emphasis on experiential learning. For several years, a central requirement of this course has been the completion of an original statistical analysis of a data set. Working in small groups of 3 or 4 members each, students were required to formulate a question of interest, use principles of the course to design a study that would address the question, analyze the data, and present results to the class. While a number of the groups produced solid analyses of interesting

questions, often the questions addressed by the groups were of limited scope or importance, e.g., taste tests of soft drinks or popping times required by various microwave ovens. Though the analysis of such questions provided useful learning exercises for the students, the external value to the greater community seemed minimal, especially in light of the substantial efforts required.

In the hopes of addressing the shortcomings of the project assignment, I modified the course in the spring of 2002 to encourage students to engage in service-learning projects by leveraging existing relationships with community partners or through the development of new partnerships with the assistance of the director of the institute for service-learning located on our campus. Following the small-group model, students continued to work in groups of 3 or 4 but were collaborating with community partners on problems of broader interest and, presumably, greater impact. Students were enthusiastic about the projects and generally found them interesting and rewarding experiences. From the viewpoint of the instructor of a class of about 25 students, the move to service-learning projects in small groups solved one set of problems while introducing new ones. Effectively overseeing the collaborations of six or more groups with different community partners proved unworkable and led to several cases in which substantial misunderstandings arose between the student groups and the partners.

3. Identifying a Project

To remedy this problem, I sought community partners with problems of sufficient scale and complexity to allow the entire class to collaborate on the same problem. Again with the assistance of our director of service-learning, I established a collaborative relationship with the director of operations for a local, not-for-profit, community health center serving the uninsured and underserved patient populations of the Kalamazoo county area. A United Way agency, the center provides services on a sliding scale fee basis and includes a 340b pharmacy on its premises.

To ensure a successful service-learning experience, I determined that suitable projects with a community partner (CP) must meet several essential criteria. First, service-learning projects should be both interesting and useful to the CP. Projects that are simply "make work" projects identified by the CP to provide something for students to do would not be suitable as they would not be compatible with the service goals of service-learning. The second important criterion for a project was that it be accessible to students in an introductory statistics class. That is, the project must be within reach of students studying elementary techniques of experimental design and sampling and basic descriptive and inferential statistical methods. The third criterion is a consequence of the quarter system followed by Kalamazoo College: the project must be sufficiently simple, well-defined and limited in scope so as to be completed in a single 10-week quarter. Given the focus of Math 260 on methods for describing and analyzing quantitative (rather than qualitative) variables, I imposed a fourth criterion that the primary response variable of the project be quantitative. Without this criterion, students might spend a significant portion of their time and efforts learning and using methods to which they had not yet

been exposed in the classroom.

With these four criteria in mind, I worked with my CP to identify an appropriate project for a service-learning experience. Based on patient complaints, health care provider schedules, and other internal tracking information, management of the center believed that waiting time experienced by patients could be unacceptably long. In particular, the CP was concerned that patients might seek health care from other immediate care facilities such as hospital emergency rooms, thereby disrupting the continuity of the patient-provider relationship. A first step in addressing the problem of excessive waits would be to carry out a comprehensive study to measure the extent of the problem and to identify any specific process bottlenecks. Given that the primary response variable of interest was quantitative (waiting time) and that the objectives were primarily descriptive, a patient waiting time study seemed an ideal service-learning project for introductory statistics students.

4. The Patient Time/Flow Study

Together with the community agency, students in my introductory statistics course completed an original statistical investigation of patient waiting times and flow through the clinic. While participation in the project was strongly encouraged, students were given the opportunity to opt out if necessary for exceptional circumstances. None chose to do so.

The project began with a classroom visit by the community partner who presented an overview of the agency and discussed the project with the students. Next, students visited the health center to experience the atmosphere of a community health center and to be trained to carry out the data collection phase of the project. Over the next three weeks, students worked in pairs to visit the center once each week for two hours to observe and record patient waiting times and comments about their experiences. The logistical challenge of transporting students to the center was simplified by two factors: 1) the center is located just 5 minutes' drive from campus; 2) we arranged the student data collection pairs so that each had at least one driver with a car on campus. (In other service-learning projects at our campus, circumstances have warranted use of a College van for transporting students.)

At the end of data collection (week 7), students submitted a short paper describing observations and reflections on their experiences at the center. By the end of week 7, a student assistant and I had entered the project data into an SPSS data set for subsequent analysis. To ensure all students had a chance to participate in the analysis, I broke the overall objective of understanding patient waiting times into smaller questions that could be addressed via relatively simple statistical procedures. Each group was assigned a different research question. For example, one group was assigned to investigate the relationship between patient waiting times and day of week while another group studied how waiting times varied across providers. During week 9, each group submitted a

preliminary "data description" pertaining to their assigned research question that served as the basis for an in-depth discussion with me. With direction from our progress discussion, each group completed a written analysis of the data set focusing on their assigned question. During exam week (week 11), the groups presented and discussed their finished analyses in a workshop session with the CP. Also, each group submitted to me a written final paper for evaluation and course credit.

5. Assessment

Overall, the project was very well received by the community partner agency. Partly as a result of our study, the agency decided to make scheduling and procedural changes to reduce waiting times and improve patient flow through the clinic. In the future, we expect to repeat the study to see if the changes have reduced waiting times.

From the student perspective, the service-learning study appeared to be more meaningful and engaging than previous group project assignments. Upon completion, the 45 students participating in the project were surveyed regarding their attitudes about it. Specifically, they were presented a list of 15 attitude statements and asked to rate their agreement with each on a 1 (strongly disagree) to 5 (strongly agree) scale. Following common survey convention and to save space, we report in Table 1 the proportion of responses falling in the top two boxes of the rating scale (percent agree or strongly agree). Of the statements presented, students were most likely to agree that the project helped them see the applicability (statement 1) and usefulness (statement 2) of statistics and that it increased their awareness of the substantive application area (statement 4) while not making excessive demands on their time (statement 14). After carrying out the study, they felt more realistic about the difficulties of fieldwork (statement 3) and more likely to be involved in their community (statement 5). Somewhat perplexing was that a fairly high percentage (71%) agreed that the project improved their ability to analyze quantitative problems (statement 6) but only 40% felt their project work directly helped them with the course material (statement 13) and just 31% said the project actually increased their interest in statistics (statement 15). These results, while still preliminary, suggest the link between the service-learning activities and the core statistical concepts of the course could be improved. One approach for doing so would make more extensive use of data collected from the project to illustrate and/or motivate statistical techniques introduced in the classroom.

6. Discussion

Overall, the service-learning project was very well received by both students and community partner. Why was the project successful? Based on direct observation and discussion with students, a critical factor in the project success was the ongoing interest and involvement of the community partner. The visibility and interest of the CP in the outcomes of the project and student learning made the students feel their efforts were appreciated and would have lasting value. Also critical were the resources and

organizational skills of our campus director of service-learning who was actively involved throughout the quarter. Finally, the commitment of students at our College to the idea of service-learning made it possible to expect students to be willing to share rides to the health center and put in the extra hours needed to carry out an ambitious project of this sort.

Table 1: Summary of Assessment Survey Results

Statement	% Agree or Strongly Agree (n=45)
1. This project helped me see how statistics could be applied to a real-world problem.	96%
2. This project helped me see how statistics could be used in everyday life.	81
3. This project increased my awareness of the challenges involved in carrying out real-world field research.	80
4. This project increased my awareness of public health issues.	78
5. This project increased my involvement in the community, civic and political activities.	76
6. This project increased my ability to analyze quantitative problems.	71
7. This project will benefit the community.	64
8. This project improved my ability to work collaboratively with others.	51
9. This project gave me the chance to make a difference in my community.	49
10. This project increased my ability to do independent research.	47
11. This project increased my ability to get along with different kinds of people with different lifestyles.	44
12. This project helped me acquire knowledge and skills applicable to a specific job or career.	41
13. This project helped me better understand the concepts and readings in this course.	40
14. This project required too much time.	37
15. This project increased my interest in statistics.	31

Acknowledgements

The author would like to thank the Mary Jane Underwood Stryker Institute for Service-Learning for its generous support through the LaPlante fellowship program in support of service-learning.

References

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