© *Journal of Higher Education Outreach and Engagement*, Volume 10, Number 3, p. 125, (2005)

Rural Outreach Chemistry for Kids (R.O.C.K.): The Program and Its Evaluation

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Abstract

The Rural Outreach Chemistry for Kids (R.O.C.K.) program was designed as a service-learning project for students at Saint Francis University to serve the local communities by organizing chemistry activities in high schools. It was initiated in 1995 and has involved a large number of Saint Francis University students and local high school students. This article presents an evaluation of the R.O.C.K. program and discussion of its findings. The evaluation was conducted using multiple evaluation designs to assess the impact of the program on high school students' interest in science and Saint Francis students' learning process and their views on service-learning. The results indicate that program was effective and had positive impact on both high school and Saint Francis students who participated.

Introduction

This article presents an evaluation of the Saint Francis University (SFU) Rural Outreach Chemistry for Kids (R.O.C.K.) Program.[1] R.O.C.K. is a volunteer organization founded by the Chemistry Department of Saint Francis University and the American Chemical Society-Student Affiliates (Chemistry Club) in 1995. The purpose of R.O.C.K. is to involve local K-12 students in hands-on science activities and demonstrate that science is important in everyone's life and can be exciting and interesting. While the program has been a service-learning program for a number of years, it had not been empirically evaluated for its effectiveness.

Students participate in the program by visiting local K-12 classes. They serve by leading younger students in hands-on science activities and learn by applying their basic scientific knowledge and consolidating their existing knowledge during this process. Although program participants have contact with students at all K-12 levels, this study was limited to high school coparticipants.

Because of the importance of R.O.C.K. to the curriculum as a service-learning program, a relatively rigorous evaluation of its

effectiveness was called for. Using available funds from the Pennsylvania and West Virginia Campus Compacts' Civic Leadership Program, researchers in the Department of Behavioral Sciences and the Department of Chemistry at Saint Francis University conducted an evaluation of the R.O.C.K. program during 2002. This article reports the results of the evaluation and describes the R.O.C.K. program.

Service-Learning and the R.O.C.K. Program

According to Carver *(1997)*, service-learning addresses three major goals of experiential education. These goals include "allowing students to become more effective change agents, developing students' sense of belonging in the communities of which they are members, and developing student competence" *(143)*. Many schools have developed curriculums that include service-learning. More than 40 percent of seniors in a study of education experiences indicated they had a service-learning project while in school *(Kuh 2003)*.

Tucker and McCarthy *(2001)* discuss how service-learning develops students' skills in presenting. Presenting to audiences outside the classroom provides challenging and mastery experiences that involve application of skills and concepts learned in class. Self-efficacy theory maintains that all processes of psychological and behavioral change operate through alterations of the individual's sense of personal mastery *(Maddux 1995)*. It is believed that expectations of efficacy lead to choices in behaviors, goals, and actions, expenditure of effort in pursuit of goals, persistence in adversity, and emotional or affective experiences *(Bandura 1986; Maddux 1995)*. The more a person practices, the more proficient he or she becomes with the skills. The more proficient the person becomes, the greater likelihood that skills will be used as they were intended.

Service-learning has several benefits related to education outcomes. Markus, Howard, and King *(1993)* found that service-learning participants had higher achievement on midterm and final tests. Students also have the opportunity to bring theories from the classroom and apply them for others in the community. Students are given the opportunity to apply their knowledge rather than simply learn and then be tested *(Paulins 1999)*.

Discussing the value that applying knowledge in community settings has for students, Kraft *(2002)* found that results vary among service-learning programs. He stated that service-learning

situations in which students tutored or educated others provided more evident intellectual benefits. Service-learners showed little other evidence of difference in terms of measurable knowledge gained.

According to Weigand and Strait *(2000)*, the American Chemical Society (ACS) identified four goals of service-learning: (1) organize, revise, and/or design materials to assist chemistry departments and faculty in developing and implementing community-based curricula; (2) develop mechanisms to recognize contributions of faculty and students to curriculum-based community interactions; (3) explore ways in which support for community-based curricula can become institutionalized; and (4) increase awareness of chemistry curricula that include community-student interactions as an integral part of the curriculum *(1539)*. One area of service the ACS discussed is support for K-12 education. The organization believed that chemistry is uniquely positioned to serve needs in the community.

"Presenting to audiences outside the classroom provides challenging and mastery experiences that involve application of skills and concepts learned in class."

As a service-learning project, the R.O.C.K. program was initiated in the Department of Chemistry during the 1994–95 academic year, in conjunction with the Chemistry Club. The Chemistry Club at Saint Francis University is also a chapter of a much larger organization, the American Chemical Society (ACS). The ACS encourages its chapters to be involved in their communities through small incentive grants and by selling activity kits but does not require its chapters to be involved in service-learning. R.O.C.K. was established to achieve several goals. First, it provides free, hands-on science activities to local K-12 students in order to spark interest in the sciences. Second, the program seeks to solidify the science content knowledge of SFU students as they act as knowledge facilitators in the K-12 classroom. Finally, it was designed to demonstrate to SFU students that service-learning is fun, meaningful, and a useful lifelong activity.

Program activities are not demonstration driven; rather, they are held in small group settings and directly engage the students. Each event is hosted by a Saint Francis Chemistry faculty member

or trained undergraduate who oversees the four to six SFU undergraduates working with the K-12 students in the activity. Each year an SFU student is appointed student R.O.C.K. director and is responsible for scheduling and other logistical issues. The features and activities of the program fit the major goals of experiential education and the ACS goals in particular.

The program provides opportunities for Saint Francis students to enhance their confidence and willingness to work with others. Through presentations and experiments in classrooms before high school students, they apply and practice what they have learned. The application and practice reinforce their knowledge and skills and their sense of achievement and contribution.

Each year the program has seen substantial growth in the number of participants and events in R.O.C.K. programs. In the first year, the program had six events that involved 130 K-12 students. During the 1996–97 academic year, the program's twenty-nine events included visits to elementary and secondary schools, and activities with youth organizations such as the Boy and Girl Scouts. Some children even traveled to Saint Francis University to visit the chemistry department and the R.O.C.K. program. As word of the program spread, the requests for visits became overwhelming. During the 1999–2000 school year, sixty-six hands-on science events engaged more than 1,425 K-12 students in the surrounding communities. (See table 1 for the numbers of events and involvement in each academic year and appendix A for the R.O.C.K. chemistry presentations.)

Table 1. R.O.C.K. Outreach—Number of Students and Schools Involved, 1998–2001

Academic year	Visited schools	Involved local students	Involved Saint Francis students
1998-1999	60	1,500	48
1999-2000	66	1,425	74
2000-2001	74	1,571	88
Fall 2001	20	428	83
Total:	220	4,924	367

To meet the need for many volunteers, the R.O.C.K. program accepts students from a number of chemistry and religion courses that have service-learning requirements. Reflections and feedback indicate that the students both enjoy and learn from the events. In addition, the R.O.C.K. program receives numerous thank-you notes and follow-up letters from the participating K-12 students.

Evaluation of the R.O.C.K. Program

Evaluation studies in service-learning: Discussion of the measurement and evaluation of the impact of service-learning on college students has included both quantitative and qualitative methods *(Priest 2001)*. Hoxmeier and Lenk *(2003)* performed evaluations to determine whether involvement in service-learning programs improved student learning. They suggested using a two-course model in which one class had a service-learning component and one had no service-learning. Test scores of nonservice-learning students could be compared to those of students in a class that included an option for involvement in service-learning.

A study of fifty-four students in a consumer sciences class who were part of a service-learning project used a preservice and postservice design to evaluate the perceived personal benefits associated with the project. The students responded to open-ended survey questions that elicited their comments on perceived personal benefits. Using content analysis, the study compared the students' comments before and after participation in the project. The results indicated that students' participation in the service-learning project raised their awareness of their roles in the community, helped them achieve emotional satisfaction, and enhanced their learning.

Simoni and McKinney *(1998)* measured the impact of service-learning involvement on nursing students. Forty-five students were involved in increasing access to health promotion and disease prevention interventions for the underserved population in the surrounding rural areas. After participation in the activity, students were asked to respond to questions on their beliefs regarding nursing competencies that were specific to community involvement. Simoni and McKinney used both quantitative and qualitative measures to identify the impact of service-learning and compared the collected data with competency measures based on the Pew Health Commission's "Competencies Needed by Practitioners." The results of the quantitative study indicated that nurses accepted the competencies as nursing responsibilities. Additionally, a

qualitative measure revealed that students were involved in increasing consumer access to community-based health care and evidenced critical thinking and the ability to meet changing needs. The qualitative results also showed that the nurses were highly supportive of service-learning and found it a dynamic and engaging learning modality. Simoni and McKinney did not indicate whether the nurses involved in service-learning differed from non-service-learning students in any of these areas.

"Academic rigor must be balanced against feasibility in implementing an evaluation methodology."

Fredericksen *(2000)* suggested that although service-learning self-assessments offered some important measures of such personal characteristics as self-esteem, social attitudes, and skill sets, there had been little research to determine whether service-learning models led to improved student performance in course work. In his study of 699 students enrolled in an American government course, he compared the quiz scores, papers, and in-class activities of students involved in service-learning and students who were not. Although scores on the first exam did not differ significantly, Fredericksen found significant differences between participants and nonparticipants on the second exam scores. The total course scores also indicated a significant difference between participants and nonparticipants.

Ewert and Sibthorp *(2000)* stated that multivariate analysis methods were useful in assessing the impact of service-learning on students. They used examples to elaborate how analysis of variance (ANOVA), multiple regression, factor analysis, path analysis, and structural equation modeling can be applied to the evaluation of service-learning programs. Although multivariate analysis methods show promise, they require large sample sizes and may involve complex measurement instruments.

Seifer and Holmes *(2002)* stated that service-learning could affect students' attitudes, satisfaction, experiences, learning, competence, civic engagement, and career plans. They suggested that written surveys and pre-and posttests on specific competencies or attitudinal measures might be valuable when assessing the impact of a service-learning project.

In summary, the literature has suggested different approaches and methods to evaluate a service-learning project. Some of the

methods are more rigorous (e.g., a pre- and posttest design) than others (e.g., a simple comparison of test scores of students in a normal class and a class with a service-learning component). Given the diversity of service-learning programs, the choice of evaluation method depends on the nature, learning module, and scope of a service-learning program, as well as available funds. Academic rigor must be balanced against feasibility in implementing an evaluation methodology.

R.O.C.K. evaluation hypotheses: R.O.C.K. is a unique service-learning program in chemistry that involves campus undergraduates and high school students. The evaluation methodology employed took into consideration the nature and design of the R.O.C.K. program and available funds in order to balance feasibility and academic rigor. The evaluation of the R.O.C.K. program includes four components: assessing the impact of the program on the perceptions and interests in science among the high school students who participated in the program; evaluating the high school students' perceptions of the R.O.C.K. activities; examining the effect of the program on the learning process of participating SFU students; and assessing the impact of the program on the SFU students' perceptions and views of service-learning.

The hypotheses employed in this evaluation assume that the R.O.C.K. program has the following effects on participants: (1) enhances high school students' interest in science; (2) enhances high school students' confidence in doing science; (3) enhances high school students' perceptions of the importance of science; (4) enhances high school students' willingness to participate in science activities; (5) elicits positive responses in high school students; (6) yields higher test scores for SFU undergraduates; (7) positively affects SFU undergraduates' perceptions and views on service-learning and their career goals.

Evaluation design: The evaluation had a high school student sample (N = 115) and a student sample at Saint Francis University (N = 45). In selecting the high school student sample, the R.O.C.K. program sent out letters in August of 2002 to local high schools (within an hour's drive of SFU) asking if schools would like to participate in R.O.C.K. Visits were scheduled on a first-come first-served basis and placed on a master calendar for a R.O.C.K. event. Six high schools were selected, and each had one class that participated in the R.O.C.K. program. The participating classes

were either chemistry or science classes in grades ten to twelve. Each of the selected classes was visited once for the R.O.C.K. presentation in the semester.

The SFU student sample consisted of students in three classes of Human Chemistry (CHEM 103). The students were physician assistant (PA), physical therapy (PT), or nursing majors. All Human Chemistry classes included students representing all three majors. One class participated in R.O.C.K., one participated in a non-science service-learning project, and one served as a control group without participating in any service-learning program.[2] Each Saint Francis student participating in the R.O.C.K. program was required to assist at only one R.O.C.K. event. Most events required a commitment of 1 to 1.5 hours, exclusive of preparation time for the event itself.

"The SFU student sample consisted of students in three classes of Human Chemistry."

Several designs were used to carry out the evaluation. They include one-group pre- and posttests to assess the effect of the R.O.C.K. program on the high school students' interest and confidence in science (hypotheses 1–4), multigroup pre- and posttests to evaluate the impact of the program on the SFU students' learning process (hypothesis 6), a one-group posttest to examine the high school students' perceptions of the R.O.C.K. program (hypothesis 5), and a one-group posttest to assess the impact of participation in R.O.C.K. on SFU students' views on service-learning and their career goals (hypothesis 7).

Several instruments were developed and used for data collection. The instrument used for the high school student sample included four pretest questions to assess students' interest in science, confidence to do science, importance attached to science, and desire to participate in science activities. The posttest instrument had three additional questions designed to assess the high school students' perceptions of the R.O.C.K. program. These questions asked whether the students enjoyed R.O.C.K., whether R.O.C.K. helped them realize that science could be interesting, and whether they were willing to participate in more R.O.C.K. All questions used a Likert-type scale ranging from 1 = Strongly disagree to 5 = Strongly agree (see appendix B for a list of the actual questions).

To assess the impact of the R.O.C.K. program on the SFU students, a shortened version of the California Chemistry Diagnostic Test, Form 1993 was used with the design of multi-group pre- and posttests.[3] The chemistry test was administered to the three groups (classes) of students—those who participated in R.O.C.K., those who participated in a nonscience service-learning program, and those who did not participate in any service-learning—before R.O.C.K. participation and after the students completed their R.O.C.K. service.

A service-learning instrument was also developed and used to assess whether participation in R.O.C.K. influenced the SFU students' view of service-learning and their career goals. The instrument was administered to the students only after they completed the R.O.C.K. service. The instrument has eight questions using a Likert-type scale ranging from 1 = Strongly disagree to 5 = Strongly agree (see appendix B for a complete list of the survey questions).

"A service-learning instrument was . . . developed and used to assess whether participation in R.O.C.K. influenced the SFU students' view of service-learning and their career goals."

Two weeks prior to the visit by the R.O.C.K. program the science interest instrument pretest was mailed to the teachers of the classes representing the high school student sample. The package included a cover letter explaining the purpose of the test and a permission slip for responding, as well as self-addressed, stamped envelopes for students to return the survey. The students were made aware that the information they provided would be confidential. During the class meeting following the presentation, teachers distributed posttest surveys to the students who had completed the R.O.C.K. program. Each survey included a cover letter explaining the purpose of the survey and a permission slip for responding.

The chemistry instructor who administered the chemistry exam also administered the service-learning questionnaire to the group (class) of students who participated in the R.O.C.K. program to collect data about their perceptions of the R.O.C.K. program. This instrument was administered as a posttest only. Paired t-tests were performed for the design of one-group pre- and posttests with repeated measures and frequencies, and percentages were calculated for the design of one-group posttests.

Evaluation results: Table 2 presents the results reflecting the impact of R.O.C.K. participation on high school student interest and confidence in science. The results show that the R.O.C.K. participation significantly increased student confidence in doing science and willingness to participate in more science activities such as R.O.C.K. (the mean difference is -0.2 for confidence and -0.4 for willingness to participate; the effect size is 0.17 for confidence and 0.36 for willingness to participate). Table 3 reports the high school students' perceptions of the R.O.C.K. program. As the results show, a majority of students (81.7%) reported they strongly enjoyed the R.O.C.K. program, more than half (52.2%) felt strongly that R.O.C.K. helped them realize that science could be interesting, and a slightly higher number (55.7%) expressed strong willingness to participate in more R.O.C.K. activities.

Table 2. The Effectiveness of R.O.C.K. Program—One-group Pre- and Posttest Design (High School Sample)

Repeated measures	Mean	Std. deviation	Mean difference	t	Sig.	N	Effect size
Interests							
Pretest	3.7	0.8					
Posttest	3.9	0.9	-0.1	-1.3	0.18	114	0.13
Confidence							
Pretest	3.6	1.0					
Posttest	3.9	0.8	-0.2	-2.2*	0.03	115	0.17
Importance							
Pretest	4.1	0.8					
Posttest	4.2	0.8	-0.1	-1.4	0.18	115	0.13
Participation							
Pretest	3.9	0.9					
Posttest	4.3	0.8	-0.4	-4.2**	0.00	115	0.36

*p < .05
**p < .01

Table 3. The Effectiveness of R.O.C.K. Program—One-Group Posttest Design (High School Sample, N = 115)

Measures	Freq.	%
Enjoyed R.O.C.K.		
Strongly agree	94	81.7
Agree	21	18.3
R.O.C.K. helped		
Strongly agree	60	52.2
Agree	44	38.3
Neutral	11	9.6
Participation in more R.O.C.K.		
Strongly agree	64	55.7
Agree	36	31.3
Neutral	13	11.3
Disagree	2	1.7

Tables 4 and 5 report the evaluation results for the assessment with the SFU student sample. As the results in table 4 indicate, students who participated in R.O.C.K. had significantly higher chemistry test scores than those who participated in a nonscience service-learning program and those who did not participate in any service-learning. The mean difference is -3.5 for the R.O.C.K. group, -1.2 for the Laurel group (nonscience program), and -1.9 for the control group (the effect size is 2.63 for the R.O.C.K. group, 0.41 for the Laurel group, and 2.07 for the control group). Finally, about half (in average across the items) the students who participated in the R.O.C.K. program at Saint Francis University expressed positive responses to the effect of R.O.C.K. participation on their career goals, their skills, and their view of service-learning (see table 5).

Table 4. The Effectiveness of R.O.C.K. Program—Multigroup Pre- and Posttest Design (Chemistry Test Scores)

Group	Mean difference	Std. deviation	Mean	t	Sig.	N	Effect size
R.O.C.K. group							
Pretest	11.1	4.0					
Posttest	14.6	3.3	-3.5	-5.4*	0.00	21	2.63
Laurel group							
Pretest	11.4	3.5					
Posttest	12.6	3.5	-1.2	-1.2	0.24	14	0.41
Control group							
Pretest	13.6	4.5					
Posttest	15.5	4.2	-1.9	-2.0	0.07	10	2.07

*p < .01

Table 5. The Effectiveness of R.O.C.K. Program—One-Group Posttest Design (R.O.C.K. Students, N = 19)

Measures	Freq.	%
Influenced goals		
Agree	10	52.6
Neither	9	47.4
Positive response		
Strongly agree	4	21.1
Agree	13	68.4
Neither	2	10.5
Assisted skills		
Strongly agree	2	10.5
Agree	13	68.4
Neither	4	21.1
Influenced view		
Strongly agree	1	5.3
Agree	14	73.7
Neither	4	21.0
Improved view		
Strongly agree	4	21.0
Agree	9	47.4
Neither	6	31.6

Discussion and Conclusion

The R.O.C.K. program was designed as a service-learning project that would create valuable opportunities for SFU students to enrich their educational experience through serving the communities. It has conducted a variety of science activities and has involved a large number of local high school students. Its effectiveness was evaluated by the present study.

The data indicate that the program was effective and in general met the proposed goals and objectives. It increased high school students' confidence in their ability to succeed in science and enhanced their interest in participation in science activities. A majority of high school students expressed their interest in and enjoyment of R.O.C.K. participation. Also, a large percentage of Saint Francis University students who did the R.O.C.K. presentations reported positive influence of their R.O.C.K. experience on their views of service-learning and their career goals. They had a significant improvement on the chemistry testing scores compared to those who did not participate in R.O.C.K. These results imply that participation in R.O.C.K. service has positive impact on stu-

dents' learning process. These findings are consistent with previous studies (e.g., *Fredericksen 2000; Paulins 1999; Simoni and McKinney 1998*) that provide evidence for the benefits of participation in service-learning. Service-learning in a content-oriented class such as a chemistry class can have a positive influence on student performance. The findings show support for maintaining the R.O.C.K. program above and beyond a "seems like a good idea" stage.

Although the R.O.C.K. program is a specific and chemistry-related service-learning program, it is based on principles and assumptions similar or identical to those of other service-learning programs. As discussed previously, service-learning programs "allow students to become more effective change agents, developing students' sense of belonging in the communities of which they are members, and developing student competence" *(Carver 1997, 143)*. The present study has provided evidence that supports these assumptions and service-learning in general. The implication is that educators as well as students may have more confidence to do service-learning given the findings. Also, if service-learning programs have a measurable positive impact on participating students as well as the audience group, more academics are likely to become involved in the programs as part of the educational process for all students.

Several caveats should be mentioned in this study. First, the evaluation designs of pre- and posttests and posttests only do not meet the academic rigor normally associated with a true experimental design. As a result, the designs do not allow us to effectively control the factors that may have confounding effects on the hypothesized outcomes of the R.O.C.K. program. Therefore, the findings should be interpreted as suggestive and preliminary. Second, given the lack of similar studies of social learning programs, it is difficult to know what effect size should be used to estimate the sample size for our evaluation study. Also, given the limited funds and small scale of the evaluation study, it might not be feasible to do a pilot study and then use the pilot data to estimate the expected effect size. Consequently, it is difficult to offer an accurate assessment of the mean differences between pre- and posttests. Therefore, any interpretation of the findings must be made with caution.

Finally, the study is a one-time evaluation in a short term. It may be enlightening to assess the long-term effects of R.O.C.K. on, for example, participants' career choices and academic success. Further research will be needed for this interest, and the research will have designs of longitudinal studies with follow-up efforts.

Acknowledgments

This study was supported by the Pennsylvania and West Virginia Campus Compacts' Fall 2001 Civic Leadership Program. The authors would like to thank Dr. Penny O'Connor and Dr. Balazs Hargittai for assisting in this study.

Notes

1. Saint Francis University, founded in 1847, is a private, Franciscan university on a six-hundred-acre mountaintop campus in Loretto, Pennsylvania. The closest large population areas are Johnstown and Altoona, thirty and twenty miles away, respectively. Service-learning was incorporated into the Saint Francis University curriculum in 1995–96 as part of the course Faith and Franciscanism (RLST 205). Since then, twenty-five programs have developed as part of service-learning. All students are required to take a service-learning-connected class during their education experience at Saint Francis University.

2. Because the classes were different sessions of the same chemistry course (CHEM 103), participants were not selected by any systematic pattern. The age, gender, and racial compositions of these sessions were comparable as assessed. Consequently, the selection bias may not be significant, although the students were not randomly assigned into each of the three sessions (groups) as strict adherence to experimental procedure would require.

3. The California Diagnostic Test was chosen because it was readily available to us. This test is provided by the American Chemical Society to determine the competence of students entering freshman chemistry. For example, the University of California used this test to place students in remedial chemistry, normal chemistry, or honors chemistry.

References

Bandura, A. 1986. *Social foundations of thought and action*. Englewood Cliffs, N.J.: Prentice Hall.

Carver, R. L. 1997. Theoretical underpinnings of service learning. *Theory into Practice 36*: 143–49.

Ewert, A. and J. Sibthorp. 2000. Multivariate analysis in experiential education: Exploring the possibilities. *Journal of Experiential Education 23*: 108–18.

Fredericksen, P. 2000. Does service learning make a difference in student performance? *Journal of Experiential Education 23*: 64–75.

Hoban, G. 1999. Using a reflective framework for experiential education in teacher education classes. *Journal of Experiential Education 22*: 104–12.

Hollinger, M. 2003. Contextual learning: A comprehensive, developmental model. *NSEE Quarterly 28*: 1–11.

Hoxmeier, J., and M. Lenk. 2003. Service learning in information systems courses: Community projects that make a difference. *Journal of Information Systems Education 14*: 91–101.

Kraft, R. J. 2002. Service learning: An introduction to its theory, practice and effects. *Education and Urban Society 28*: 131–37.

Kuh, G. 2003. What we're learning about student engagement from NSEE. *Change 35*(2): 24–34.

Maddux, J., ed. 1995. *Self-efficacy, adaptation, and adjustment*. New York: Plenum Press.

Markus, G., J. Howard, and D. King. 1993. Integrating community service and classroom instruction enhances learning: Results from an experiment. *Educational Evaluation and Policy Analysis 15*: 410–19.

Paulins, V. 1999. Service learning and civic responsibility: The consumer in American society. *Journal of Family and Consumer Sciences 91*: 66–73.

Priest, S. 2001. A program evaluation primer. *Journal of Experiential Education 24*: 34–41.

Seifer, S., and S. Holmes. 2002. Tools and methods for evaluating service learning in higher education. Community-Campus Partnership for Health. Bothell, Wash.: University of Washington School of Public Health. http://depts.washington.edu/ccph/servicelearningres.html (2 March 2003).

Simoni, P., and J. McKinney. 1998. Evaluation of service learning in a school of nursing: Primary care in a community setting. *Journal of Nursing 37*: 122–29.

Tucker, M., and A. McCarthy. 2001. Presentation self-efficacy: Increasing communication skills through service learning. *Journal of Managerial Issues 13*: 227–45.

Weigand, D., and M. Strait. 2000. What is service learning? *Journal of Chemical Education 77*: 1538–40.

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Appendix A: Major R.O.C.K. Chemistry Activities

- Slime and Silly Putty (grades K–6): Learn about polymers by making your very own "slime" using Elmer's white glue and "silly putty" using carpenter's glue and combining them with an aqueous borax solution;
- The Effects of Temperature on Lightsticks (grades 3–12): See the differences in intensity of light in the lightsticks due to exposure to hot, cold, and room temperatures and learn about chemical reactions;
- Eggshell Geodes (grades 3–6): Make your own geodes (R.O.C.K.s with crystals inside) using eggshells and alum;
- Vision (grades 3–8): Learn how your eyes work by looking at blind spots, depth perception, and a Magic Eye picture;
- Liquid Nitrogen (grades 9–12): Learn the properties of liquid nitrogen through experiments using balloons, superconductors, and even making ice cream;

- Oobleck (grades K–2): Listen to Bartholomew and the Oobleck by Dr. Seuss, then make your very own Oobleck using cornstarch and water while learning the properties of solids and liquids;
- Chromatography (grades 2–10): By using cloth, markers, and isopropyl alcohol, learn the process of purifying chemicals;
- Super Soakers (grades 7–12): Learn what's in a diaper that helps to keep a baby dry;
- Dry Ice (grades 4–7): Learn the properties and uses of dry ice and even make homemade root beer;
- Oily Oceans (grades K–3): Learn what happens during an oil spill and help clean a bird; and
- Milk Makes Me Sick (grades 11–12): Look at factors affecting the rate of a reaction and find out what it really means to be lactose intolerant.

Appendix B: Instrument Items

High School Students:

- I enjoyed the R.O.C.K. presentation.
- I am confident that I can do well in science.
- The R.O.C.K. presentation helped me realize that science can be interesting.
- An understanding of science is important in our lives.
- I am interested in science.
- I would like to participate in more R.O.C.K. activities.
- I like participating in science activities.

SFU Students:

- I am motivated to participate in service learning.
- Participation in the service learning project influenced my educational goals.
- Participating in the service learning project is a positive response to my civic duty.
- Participating in the service learning project has assisted me in developing skills to pursue my career.
- Participating in the service learning project has influenced my view of service learning.
- Participating in the service learning project improved my view of service learning.
- The service learning project is applicable to education.
- Overall, service learning seems to help students.