Research Institutions' Teaching Imperative: Rising to the Commitment of Service-Learning in Engineering Education

Dr. Bowa George Tucker, University of Massachusetts, Lowell

Bowa George Tucker, Ed.D. is a Senior Research Associate for the National Science Foundation funded Engineering Faculty Engagement in Learning through Service, and Engineering for the Common Good in the College of Engineering at the University of Massachusetts, Lowell. His received his doctorate from the University of Massachusetts, Boston in Higher Education Administration in 2010. His dissertation research produced a rigorous qualitative study entitled Uncovering the Civic Dimensions of Service-Learning in Higher Education: A Multi-Case Study. Dr. Tucker has extensive experience in program management and evaluation of multiyear, multimillion dollar partnership programs, including the U.S. Department of Education, and the U.S. Department Housing and Urban Development. His expertise includes assessment in teaching and learning outcomes in k-12 and in higher education, diversity, leadership, community outreach, and curriculum development.

Prof. David O Kazmer, University of Massachusetts, Lowell

David Kazmer is a Professor of Plastics Engineering at UMass Lowell. His teaching and research are related to product and machine design, systems modeling, and controls. He is an inventor with over twenty patents and the author of more than two hundred publications including two books. A Fellow of the American Society of Mechanical Engineers and Society of Plastics Engineers, he is the recipient of over twenty different recognition awards including the Office of Naval Research Young Investigator Award, the National Science Foundation CAREER Award, and the ASME Ishii-Toshiba Award for sustained and meritorious contribution to Design for Manufacturing and Life Cycle.

Dr. Chris Swan, Tufts University

Chris Swan is the Associate Dean of Undergraduate Curriculum Development in the School of Engineering and an associate professor in the Civil and Environmental Engineering department at Tufts University. He has additional appointments in the Department of Education, Jonathan M. Tisch College of Citizenship and Public Service and Center for Engineering Education and Outreach at Tufts. He has been an active member of the American Society for Engineering Education, having served at various officer posts for the Environmental Engineering Division (2003-7) and the Community Engagement Division (2011 – present). His current research interests in engineering education focus on project-based learning and service-based pedagogies. He also does research on the impact of temperature (heating and/or freezing) on engineering properties of soils and on the development of reuse strategies for waste materials.

Dr. Angela R Bielefeldt, University of Colorado, Boulder

Angela Bielefeldt, Ph.D., P.E., is a Professor in the Department of Civil, Environmental, & Architectural Engineering at the University of Colorado Boulder. She has been on the faculty since 1996. She serves as the ABET Assessment Coordinator for the Department. Professor Bielefeldt teaches introductory courses for first year engineering students, senior capstone design, and environmental engineering specialty courses. She conducts engineering education research related to learning through service (LTS), social responsibility, sustainability, ethics, and globalization.

Prof. Kurt Paterson P.E., James Madison University
Dr. Olga Pierrakos, James Madison University

OLGA PIERRAKOS is an associate professor and founding faculty member of the James Madison University Department of Engineering. At JMU, Dr. Pierrakos is the Director of the Center for Innovation in Engineering Education (CIEE) and Director of the Advanced Thermal Fluids Laboratory. Her interests in engineering education research center around recruitment and retention, engineer identity, engineering design instruction and methodology, learning through service, problem based learning methodologies, assessment of student learning, as well as complex problem solving. Her other research interests lie in

cardiovascular fluid mechanics, sustainability, and K-12 engineering outreach. Dr. Pierrakos is a 2009 NSF CAREER Awardee. Dr. Pierrakos holds a B.S. in Engineering Science and Mechanics, an M.S. in Engineering Mechanics, and a Ph.D. in Biomedical Engineering from Virginia Tech.

Mr. Gregory Allen Rulifson, University of Colorado, Boulder

Greg Rulifson is a doctoral student in Civil Engineering focusing his research on engineering education. Greg earned a bachelor's degree in Civil Engineering with a minor in Global Poverty and Practice from UC Berkeley and earned a master's degree in Structural Engineering from Stanford University. His current research focuses on understanding engineering students' conceptions of social responsibility, how engineering service is valued professionally, as well as how faculty can be facilitated to engage students in engineering service more effectively.

Ms. Linda Barrington, University of Massachusetts, Lowell

A Research Institution's Teaching Imperative: Rising to the Commitment of Service-Learning in Engineering Education

Abstract
For over two decades, a number of engineering faculty members at a research institution of higher education in the United States have successfully integrated service-learning in their courses as an effective curricular strategy. While some faculty members have continued to integrate service-learning in their teaching, others have discontinued its use. This inquiry examines the reasons faculty discontinued the integration of service-learning in their courses. Specifically, it focuses on engineering faculty members at a public research university. Most studies on faculty involvement with service-learning have focused on factors that influence whether or not faculty adopt service-learning pedagogy, and no study has investigated factors for discontinuing the use of service-learning in engineering. A qualitative research approach is used to conduct in-depth interviews of engineering faculty using a semi structured protocol. The interviews were aimed at identifying the faculty experience, and at interpreting the reasons for discontinuation. The research findings indicate that faculty discontinued the use of service-learning simply because they no longer teach the course. Even so, the common theme that emerged among the faculty was that most believed in service-learning's intended educational outcome.

Introduction: The Emergence of Research Institutions
In examining the historical trajectory of higher education missions in the United States, Talcott (2005), for example, suggests that the mission of higher education from the colonial period to throughout the nineteenth century was different from what is generally taken to be its mission in the twentieth century. That is, the mission of college education throughout the nineteenth century was taken to be the development of moral character. This focus stemmed from the "British tradition of training the whole person." The mission of modern research universities, on the other hand, is seen as having derived from the "German traditions emphasizing specialization and research" (Talcott, p. 2). Therefore, as the American society became more and more technologically advanced, academic departments became more specialized.

Altbach (2001) indicates that the emergence of graduate education in the United States was an important factor that changed the landscape of higher education. This was largely facilitated by the creation of the Morrill Acts of 1862 and 1890 that led to the creation of land grant colleges and universities. This development followed "the rise of public universities, the ethos of public service, and the linking of research to agricultural and industrial development" (p.14).

According to Altbach "the land-grant institutions combined several key ideas in American higher education: the *concept of direct service to society*, the traditional idea of liberal arts studies as the cornerstone of undergraduate education, and the emphasis on research as part of the academic enterprise" (p.14). These developments encouraged diverse expressions of missions in higher education. For example, Pollack in (Stanton et al, 1999) states "liberal arts colleges emphasize teaching, professional schools and community colleges emphasize training and large universities emphasize research"(p. 14). Despite these differences, Boyer (1990) argued that the modern research university model now dominates American higher education, and the focus on research

in American higher education was at the expense of teaching. Instead Boyer called for a refocus on the scholarship of teaching.

Curriculum Reform to Improve Teaching and Learning in Higher Education

Boyer's (1990) call for higher education curricula reform that promotes teaching and learning among students has important implications for what faculty members teach, how they teach, and what students actually learn. For example, while faculty may exercise great latitude in developing the curricular goals and objectives in the courses they teach, Wiggins and McTighe (2005), suggest a backward design model based on the notion that the design process should start with pointing out the desired learning results and then "work backwards" to develop instruction. This approach is a departure from the traditional method of identifying the goals that need to be covered as the first step in curricula planning.

In their framework, Wiggins and McTighe (2005) identified three stages: (1) Identify desired outcomes and results, (2) Determine what constitutes acceptable evidence of competency in the outcomes and results, and (3) Plan instructional strategies and learning experiences that bring students to these competency levels. They posit this approach will help faculty design instruction that promotes understanding and fosters student engagement.

Another important approach to curricular reform that called for improvement throughout undergraduate education has been in service-learning pedagogy. Service-learning is a teaching method in which students participate in organized service activity for academic credit that meets identified community issues, and that reflection done by the students on their service experience furthers their understanding of course content (Zlotkowski, 1999, Erickson & Anderson, 1997; Morton & Troppe, 1996; Jacoby, 1996; Marullo,1996; Bringle & Hatcher, 1996; Stanton, Giles, & Cruz, 1999)

For nearly three decades service-learning pedagogy has increased in higher education as a practical teaching and learning method (Campus Compact, 2006). For example, Colby et al. (2003) referenced a report by Sax et al. (1999) of a survey conducted by the Higher Education Research Institute of faculty who teach undergraduate courses. The survey revealed that 19.8 percent of faculty at two-year colleges and 24.1 percent of faculty at four-year colleges said they had taught at least one service-learning course.

Research Question and Purpose

The aim of this paper is to explore the continued practice of service-learning as an effective teaching method within an engineering curriculum at a public research institution of higher education with a mission committed to excellence in teaching, research and community partnerships. While some faculty members continue to integrate service-learning in their teaching, others have discontinued its use. Most studies on faculty involvement with service-learning have focused on factors that influence whether or not faculty adopt service-learning pedagogy, and no study has investigated factors for discontinuing the use of service-learning in engineering. This study examines the motivation for faculty involvement in service-learning in the college of engineering, and the reasons why faculty discontinue the use of service learning in their courses. The primary research question is:

Why do faculty members use and discontinue the use of service-learning?

The purpose of this study is to understand the level of faculty commitment to service-learning as an effective teaching and learning method.

Research Method

Case studies are the most common way of doing qualitative research (Stake, 2003). Stake (1995) recognizes that there are many other types of case studies based on their specific purpose, such as the teaching case study or the biography. He posits that the number and type of case studies depends upon the purpose of the inquiry: an instrumental case study examines one or more cases to provide insight into an issue; an intrinsic case study is undertaken to gain a deeper understanding of the case; and a collective case study is the study of a number of cases in order to inquire into a particular phenomenon. In a collective case study, the sample is purposive, and the criteria for selecting cases should be to "maximize what we can learn" (Stake, 1995, p. 4). The cases may be "similar or dissimilar, redundancy and variety each important" (Stake, 2003, p.138)

A collective case study is used to conduct in-depth interviews of engineering faculty using a semi structured protocol. The interviews were aimed at identifying the faculty experience and at interpreting the reasons for using and discontinuing service-learning. The cases are dissimilar in that one set of cases will comprise of faculty that continue to use service-learning and the other set of cases is composed of faculty that are no longer teaching a course with a service component. The aim is to "maximize what we can learn" (Stake, 1995, p. 4).

Research Site and Participant Selection

The Research site is a public research institution where courses with service-learning have been integrated into existing required courses in five engineering departments over the past seven years. A list of service-courses with the names of the corresponding faculty was furnished by the service-learning coordinator to the researchers. A representative sample of faculty was purposefully selected from the various departments comprising of mechanical, chemical, electrical and computer, plastic, and civil. A total of currently 24 currently practicing faculty members were interviewed of which 20 were males and 4 were females. Five faculty members were interviewed from each of the College's departments with the exception of civil engineering in which 4 faculty members participated. A total of 8 faculty members that discontinued the use of service-learning were interviewed; seven were male and 1 female. An interview protocol was used with the interview questions designed to gather information about faculty attitudes towards service-learning, the perceived cognitive and affective impacts on faculty from integrating service-learning in their teaching, and the reasons for discontinuation. As such, the interviews provided rich descriptive data of the participants' view of service-learning.

Findings:

This section describes the results of this inquiry. The investigation utilized data from interview transcripts to discover faculty attitudes towards service-learning. First, interview transcripts of faculty currently engaged service-learning were analyzed because they are the key in

understanding faculty motivation and challenges in teaching a courses with service-learning. Secondly, the transcripts of the interviews of faculty not currently using service-learning were analyzed to understand the reasons for their discontinuation.

Affective Impact on Faculty:

Opportunity to Work with People in the Community: In terms of affective impact on faculty, the feeling of having an opportunity to provide useful service to the clients was very consistent across all faculty. For example, one faculty commented:

> *"I think that I got an opportunity to know people that I don't normally have an opportunity to talk with; which really expands my eye sight and horizon to know that there are many people out there in need of help with these technical problems, and at the same time we do have the ability to help them. That's something that I didn't think about before."*

This view was consistent among the faculty.

Cognitive Impact on Faculty:

An Inspirational Approach to Teaching: 95% of the faculty members that were interviewed indicated that service-learning has a positive impact on their teaching. For example, one faculty states:

> *"We have this new perspective, and I think that this really inspired me to look at the future and how we should design our course modules, and design our labs."*

Another faculty states:

> *"I've been pretty interested in this issue of how students learn; and that's in part why I wanted to teach a freshmen course. So that I could be more closely connected to that, and improve it. I have actually read a lot of articles and written publications. So, I'm a big supporter of S-L, as an active learning method. The service initiative, and the service component is very powerful as long as we have good projects; and they can be well integrated into the courses."*

To Increase Student Motivation to Learn: 95% of the faculty members expressed their interest in service-learning primarily because they viewed it as a way to motivate students to learn. In their view, students become more motivated to learn and to develop technical skills when the learning goes beyond the classroom. Therefore, service-learning was viewed as a value-added teaching strategy to enhance student learning of engineering content. As such, they were motivated to use service-learning to ensure students' mastery of technical disciplinary knowledge. For example, one faculty states:

> *"The students are more motivated and show more interest… So, I think that the significance is that students are very excited and more enthusiastic about that assignment."*

Another faculty states:

> *"At the beginning of the service-learning, there is a lot of information that the students must find, which then forces them to learn."*

The view of S-L as an initiator for student learning was consistent among the majority of the faculty members. They became interested in incorporating service-learning in their teaching in order to get students more excited about what they learn.

To Enhance Students' Ability to Make a Difference: Although the faculty acknowledged their primary interest in service-learning stemmed from the fact that it motivated students to learn, they also realized the importance of making a difference in the lives of others by solving real world problems. For example, one states:

> *"Clearly, students do perform better when they feel that they are going to make a difference. And making a difference in something that lies in a service capacity is extremely powerful; there is no doubt about it."*
>
> *"The difference is that with homework that is just a grade, but with service-learning, that is real which is helpful. The service-learning helps very much for students to think and to learn in good ways."*

The above quotes are representative of the thoughts of the majority of the faculty engaged in service-learning at the College of Engineering. As such, the faculty motivation for service-learning is not only to enhance students learning, but also to help students in making a difference to solve problems in the community in order to improve the lives of others. Through service-learning the faculty members are thus able to teach students to apply the theory they learn in their classrooms to solve "real world" problems. Hence, the faculty believed that when students apply their knowledge to real world problems, it reinforces students' motivation to learn.

Challenges:

Time Requirements: For all of the faculty, time is a major challenge. The faculty members were aware of the fact that the design of a good service-learning projects that produces an authentic learning experience takes a great deal of time to develop. One participant states:

> *"The amount of work in my course affects my level of service-learning initiatives… it takes significant time and effort."*

Although all of faculty expressed this concern, the issue did not deter their commitment to service-learning. This is largely due to their belief in the fact that service-learning provides a powerful tool to enhance student learning while addressing problems to make a difference in society.

Faculty Members Who Discontinued Service-learning

Course assignment which included a service-learning project: When asked how faculty got involved with teaching a course that included a service-learning project, the majority of the faculty stated that they were assigned to a course already incorporating S-L. The statement below by one faculty is representative of the group:

> *"I inherited the intro to engineering course. It was challenging because it was with a large number of students."*

In addition, a few of the faculty designed the course and incorporated service-learning project because they were asked. One faculty states:

> *"I was asked to participate. I incorporated the service-learning component into the course. It did not take away the content: it helped enhance it."*

Positive experience with service-learning: With the exception of one faculty member, all of the participants expressed a positive experience with service-learning.

> *"It was a very positive experience for the students and for me. It was motivating for me to do something different."*

Another faculty states:

"It helps to reinforce the material that is being covered in the class."

However, not all of the faculty members had a positive experience. One faculty member was adamantly opposed to service-learning. This faculty member states:

"I have been critical of service-learning, as most will tell you. Students think that the service-learning capstone is torture for them. They are not interested in health projects. Some change regarding this would be good. Students should be allowed to choose other projects with other professors, and do things according to ABET."

This faculty was opposed service-learning and felt it should not be mandatory for students. Rather it should be optional and students should be given the choice to work on projects that interest them.

No Longer Teaching the Course: All of the faculty members stated they no longer teach the course in which they had implemented S-L. For example, one faculty states:

"I was asked to incorporate it [service-learning]. I don't teach that course anymore."

Another faculty states:

"The main reason I don't teach a service-learning course is because the course is being phased out. It was hard to get enough specifics as we were not working directly with a local community partner. We were getting everything second hand."

In addition, another faculty states:

"I only teach graduate courses now."

When asked if they would be willing to teach a service-learning course again. All of the faculty with the exception of one responded in the affirmative.

Summary of findings:

The summary of the findings is provided in Figure 1. The affective impact of Service-Learning in the engineering curriculum is the opportunity to work with people in the community. It is our experience that most Service-Learning course assignments due result in course completions including deliverables to the community client(s). Most of the interviewed faculty reported positive outcomes, with only a small minority (less than 10%) reporting a negative experience that led to cessation of Service-Learning activities.

Our research indicates that Service-Learning has a positive cognitive impact on faculty, with faculty reporting that Service-Learning is an inspirational approach to teaching. Other research as well as our own has also shown that Service-Learning also has a positive cognitive impact on students that includes increased motivation to learn curricular content as well as enhanced self-efficacy after project completion. These positive outcomes were either directly reported or agreed to by the vast majority of interviewed faculty members.

Even with these positive impacts, we have recorded an attrition rate of approximately 10% of Service-Learning practitioners per year. The first stated reason for cessation of Service-Learning was a change in course assignments and/or requirements. Specifically, Service-Learning projects that address curricular needs are not always readily available for all engineering courses. Course re-assignments may then prevent a willing Service-Learning practitioner from continuing this pedagogy. The other commonly stated issue is faculty workload, with faculty reporting that the support of Service-Learning requires more time and effort than alternative course teaching methods. Interestingly, workload issues have arisen at all levels of faculty rank.

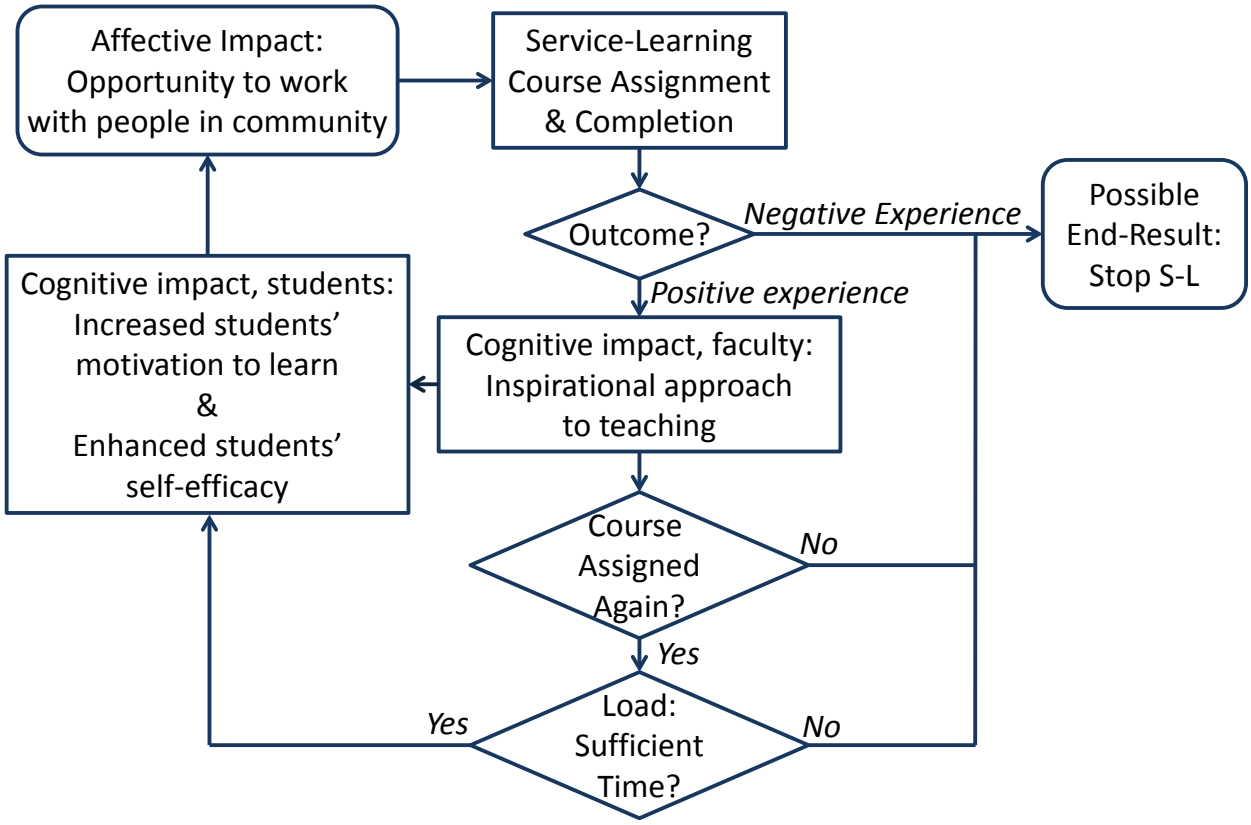

Figure 1: Flow chart depicting Service-Learning outcomes

Discussion:

Based on the analysis of the interviews from a representative sample of faculty from all engineering departments, the findings point to the fact that service-learning has been successfully integrated and widely accepted in the College of Engineering. The view of having an opportunity to work with people in the community was consistent among the faculty. This demonstrates that service-learning has, in fact, had a positive affective impact on the faculty. It illustrates that engineering faculty members value the connection it makes with members of the communities in which students engage in learning. By virtue of having the opportunity to interact with numerous partners outside of the university, it has enabled faculty to offer services in the communities by solving technical problems.

In addition, while a very small number of faculty members expressed their reservation about the efficacy of service-learning, an overwhelming majority of faculty (95%) view service-learning as an inspirational approach to teaching. Hence, the use of service-learning activated their metacognition about their teaching and the impact on students' learning. They are convinced that service-learning forces them to think about their teaching in creative ways and that the approach is conducive to intellectual development.

Also, from a curricular standpoint, the faculty members were motivated to integrate service-learning in their teaching because of the potential to improve students' learning outcomes in their

particular courses. The primary factor that motivated the majority of the faculty was to improve students learning outcomes, especially at it related to learning specific course materials. While service to the community or the ability for students to make a difference in the community was also a motivating factor, student learning of course objectives played a far more important role for the majority of the faculty. This is consistent with the literature specifically, with respect to service-learning. Numerous studies on service-learning in higher education have established consistent direct links to student mastery of course content (Eyler & Giles, 1999). These studies have provided sufficient evidence to indicate that participating in service-learning helps students to understand and apply the course material through application to open-ended problems. When students connect course material to their activities in the community, it increases their ability to grasp course concepts. This is important because service-learning has the unique aspect of reflection to capture and guide learning.

Although the amount of time required to coordinate service-learning efforts was overwhelming for the faculty, the majority remained resolved in their commitment to using this pedagogy. The faculty members that have discontinued service-learning are a result of not teaching a class that has a service-learning project. By and large they agree service-learning can be an effective teaching approach for certain courses.

Conclusion:

The research findings indicate that some faculty were initially motivated by financial incentives in the form of $500 mini-grants, and when the incentive on longer existed they were not inclined to continue due to the additional work involved. In addition, other discontinued the use of service-learning simply because they no longer teach the course. Finally, others discontinued service-learning due to the nature of the course offering. However, a common theme that emerged among the faculty was that they all believed in service-learning's intended educational outcome.

In conclusion the results of this research suggest a public research university has made significant strides in adopting service-learning in the college of engineering to improving the way faculty teach and the way students learn. Although there are challenges in terms of the time it takes to implement a successful service-learning course, service-learning continues to be an integral part of the curriculum. The support for service-learning is largely due to having committed faculty members, the support of the Dean, and the college's commitment to fund a fulltime coordinator of service-learning in the college of engineering. To the extent that attrition does occur, it is important to have the institutional mission and support to attract new faculty members to maintain a critical mass of participants and vibrant community.

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FACULTY INTERVIEW Protocol

Recruitment Protocol: Each faculty member will be informed of confidentiality, anonymity, and rights of withdrawal procedures that are included on the Informed Consent Form for this study.

Demographic Information

1. Gender: __ Male __ Female

2. Which of the following(s) describe your current position?

☐ tenure-track and I have tenure
☐ tenure-track and I do not have tenure (yet)
☐ non tenure-track
☐ administrative; please specify (i.e., department chair/head, dean, etc.) _____

3. Please check your department:

☐ Electrical and Comp Eng ☐ Civil and Environmental
☐ Chemical Eng ☐ Plastic Eng
☐ Mechanical Eng
☐ Other _____

Use of S-L

1. How did you become interested in using S-L in your teaching? When did you start using it? Why? What has kept you going?

2. Can you briefly explain how you are using Service-Learning in your classes? (What curricular units does the S-L project tie into?)

3. What tools/methods/ strategies do you use to get students to analyze the connection between their project and the social problems it addresses?

4. What had been the greatest benefit in using S-L in your teaching?

Challenges/Supports

5. As a faculty member, what are the primary challenges in using S-L?

6. What kinds of support do, or would, make it easier?

Impacts

7. What kinds of changes have you seen in student learning or other experience since you began using LTS (compared to when you did not use LTS)? (i.e., has LTS made a difference for your students?)

8. From your perspective, did the S-L experiences help students to better understand some of the concepts taught in your course(s)?

9. What has been the positive impact on *you* in engaging in S-L?

10. What are you hoping that S-L will accomplish?

11. Anything else/other comments?

Questions for faculty who tried S-L and discontinued:

A. How did you become involved in S-L? Did you inherit a course that integrated S- L and continued this approach or did you specifically design a course around S-L?

B. Could you describe any trade-offs between the time/cost of S-L and its benefits?

C. Why did you decide to discontinue teaching courses that involve S-L?

D. Would you go back to teaching a course with S-L if encouraged by your peers, chairs, or dean?