

Cultivating Mathematical Affections Through Service-Learning

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Describe your ideal math graduate



The Industry Standard

- “Being mathematically literate includes having an appreciation of the value and beauty of mathematics as well as being able and inclined to appraise and use quantitative information.”
 - NCTM Standards for Teaching Mathematics
- “Mathematical proficiency has five strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.... Productive disposition is the habitual inclination to see mathematics as sensible, useful, and worthwhile.”
 - *Adding it Up: Helping Children Learn Mathematics*
(National Research Council)

As it stands...

- As it stands our current methods of teaching mathematics are producing untold numbers of students who see mathematics more about natural ability rather than effort, who are willing to accept poor performance in mathematics, who often openly proclaim their ignorance of math without embarrassment, and who treat their lack of accomplishment in mathematics as permanent state over which they have little control.
 - Douglas McLeod in *Handbook of research on mathematics teaching and learning* (1992)

Modifying belief structures

- Mathematics educators who set out to modify existing, strongly-held belief structures of their students are not likely to be successful addressing only the *content* of their students' beliefs...it will be important to provide experiences that are sufficiently rich, varied, and powerful in their emotional content to foster students' construction of new meta-affect.
 - G.A. Goldin in *Beliefs: A hidden variable in mathematics education?* (2002)

My intro to S-L

- The BIG question:

“Why should I value this?”



Overview

- **WHAT** is service-learning?
- **WHY** consider implementing a service-learning project?
- **HOW** do you implement a service-learning project?
- **WHERE** can you find additional resources?

I. WHAT IS SERVICE-LEARNING?

WHAT is Service-Learning?

- Defining Service-Learning:
 - At a basic level, service-learning can be defined as a set of activities that have two characteristics:
 - 1) they enhance either the delivery or the impact of the curricular material, usually, but not always, within the context of a specific course, and
 - 2) they take place within a service framework where additional experience with civic engagement or social contribution will be obtained.

Hadlock, C.R. (2005). "Introduction and Overview." In C.R. Hadlock (Ed.), *Mathematics in service to the community: Concepts and models for service-learning in the mathematical sciences*. Washington, DC: Mathematical Association of America.

WHAT is Service-Learning?

- Taking your class to clean up litter off the side of the road
 - Service framework/Social contribution? ✓
 - Enhance curricular impact of math? ✗
- Assigning practice questions on a given topic
 - Service framework/Social Contribution? ✗
 - Enhance curricular impact of math? ✓
- Gathering and testing data for the city to see if certain areas are more prone to littering than others
 - Service framework/Social contribution? ✓
 - Enhance curricular impact of math? ✓

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- In the context of mathematics:
 - AP Stats: Identifying a non-profit service agency which requires survey research (program evaluation, client needs assessment, etc.)
 - Geometry: Students complete an architectural design project for a local affordable housing development

WHAT is Service-Learning?

Examples:

- Evaluating the effectiveness of the county in providing aid to wildfire victims as compared to the aid provided by volunteer organizations
- Examining volunteer and camper retention in an inner city after school program
- Analyzing adoption trends for a local no-kill animal shelter
- Determining community satisfaction in regards to new developments by the city parks and recreation department
- Comparing drug/alcohol abuse before and after establishing residence in an affordable housing community for the chronically homeless

WHAT is Service-Learning?

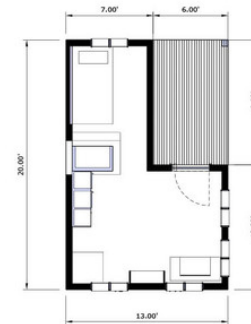
- Canopy for parked RV
- Gazebo
- Spiral herb garden
- Artistic bike rack
- Tiny house



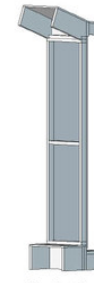
to create a flexible living space that creates opportunities for varying degrees of private and public interactions. The house is simply furnished and designed to meet the most basic needs of comfortable living while maintaining a degree of flexibility in use. Occupant comfort is enhanced by use of a ceiling fan and the high, sloping ceiling which allow for cross ventilation in the warmer months.

The house was conceived as a simple, stick-framed structure that can be built by anyone with access to conventional tools and basic carpentry skills. The interior and exterior can be finished with a variety of materials from metal panels to Hardie board or wood, depending on what is currently available and affordable.

Despite its small size, the house gracefully combines several elements, such as a sunny nook, varying degrees of public/private space, and multifunctional storage and seating to create a peaceful place one could call home.



Floorplan
Scale 1/4"=1'-0"



Construction Detail
Scale 1/2"=1'-0"



Building Section
Scale 1/4"=1'-0"



Elevations
Scale 1/8"=1'-0"

II. WHY CONSIDER SERVICE-LEARNING?

WHY Consider Service-Learning?



WHY consider Service-Learning?

“Nothing against stats, I'm just not very good at it. I just have to dig in when I really want to learn something. I have to spend a lot of time on it. In some ways, I felt like having to use stats to figure out what we learned was frustrating, but I thought it was good too. The benefits were, I was actually seeing this was a real life thing. You're going to use stats in really life. You're going to be able to actually benefit people. You're going to benefit yourself.”

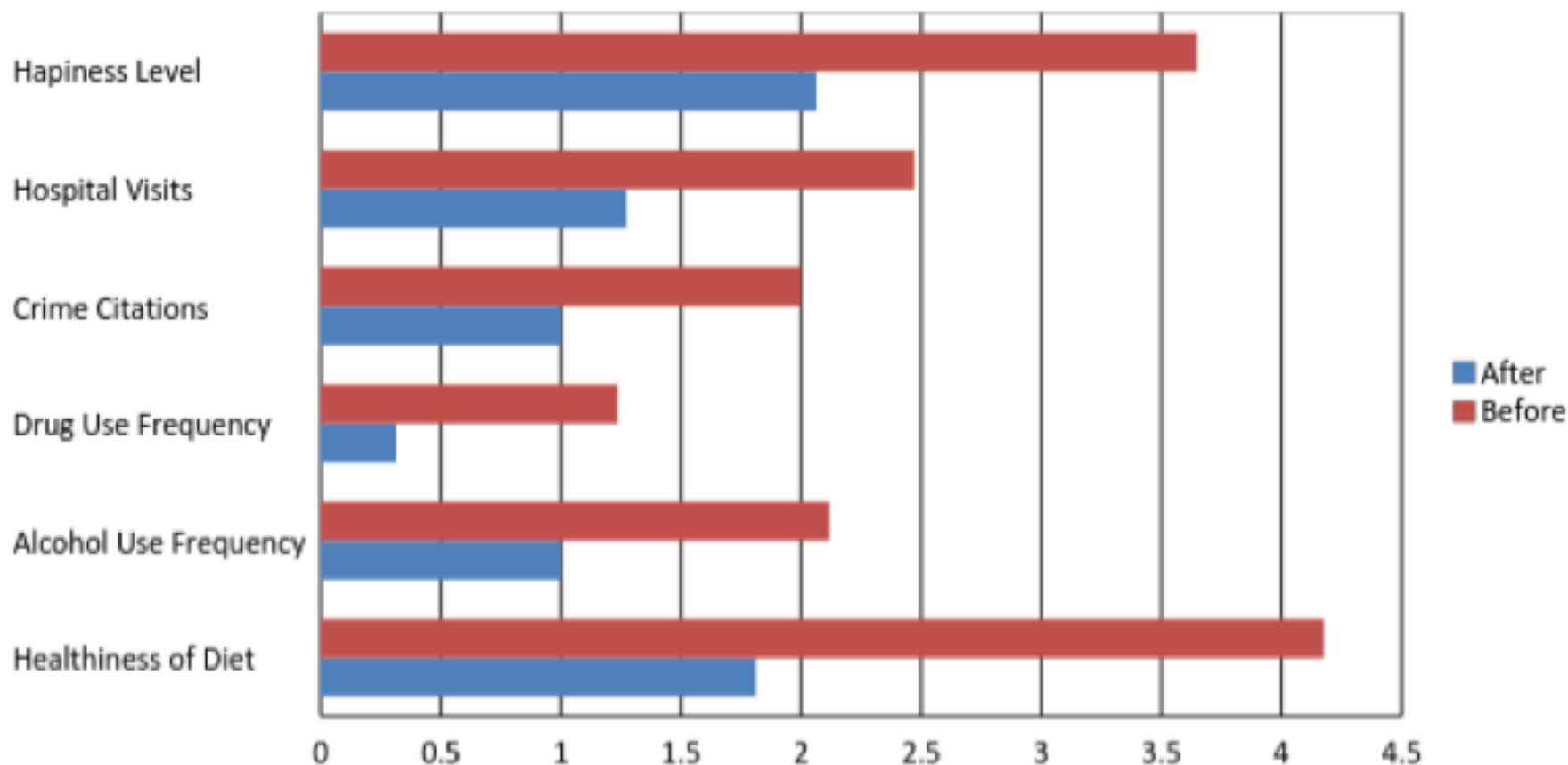
- Student quote on the stats service-learning project from this past year

WHY Consider Service-Learning?

- The enhancement of curricular impact can derive from different sources:
 - Exposure to new techniques and ideas
 - Motivation from seeing curricular material in action
 - Higher student energy level due to bonding with a client organization and helping meet its needs
 - More extensive discussion of course material due to the interactive nature of most service-learning projects
- Ultimately the motivation for service-learning is not only developing higher-order critical thinking in real-world contexts but also increasing the feeling of engagement on the part of the student

Average Responses Before & After Community First!

(Rated on a 0-5 scale with lower numbers indicating a more positive response)



The p-value is 0.041, and assuming that there is no difference in the average number of words per page between *The Eagle* and *The Examiner*, there is a 4.1% chance of getting a value this large or larger. Because the p-value is less than alpha, 0.05, I reject the null hypothesis and the results are statistically significant.

examined the number of words per page in several issues of the newspaper after we, I also believe other newspapers, and this is a conclusion to be made.

Conclusion:

According to the data in which we collected through experimentation, we have noted that the P-value (8.1154237e-6) is lower than our Alpha value (0.05), which means...

WHY Consider Service-Learning?



WHY Consider Service-Learning?



WHY Consider Service-Learning?



WHY Consider Service-Learning?

“I think that I do more math, like this year I've done more math, and my outlook has changed on that, just because the service learning project has been more engaging and more exciting than sitting down and taking notes, and I really wanted to use what I've learned throughout the year and actually apply it, so I think it was more engaging and more fun.”

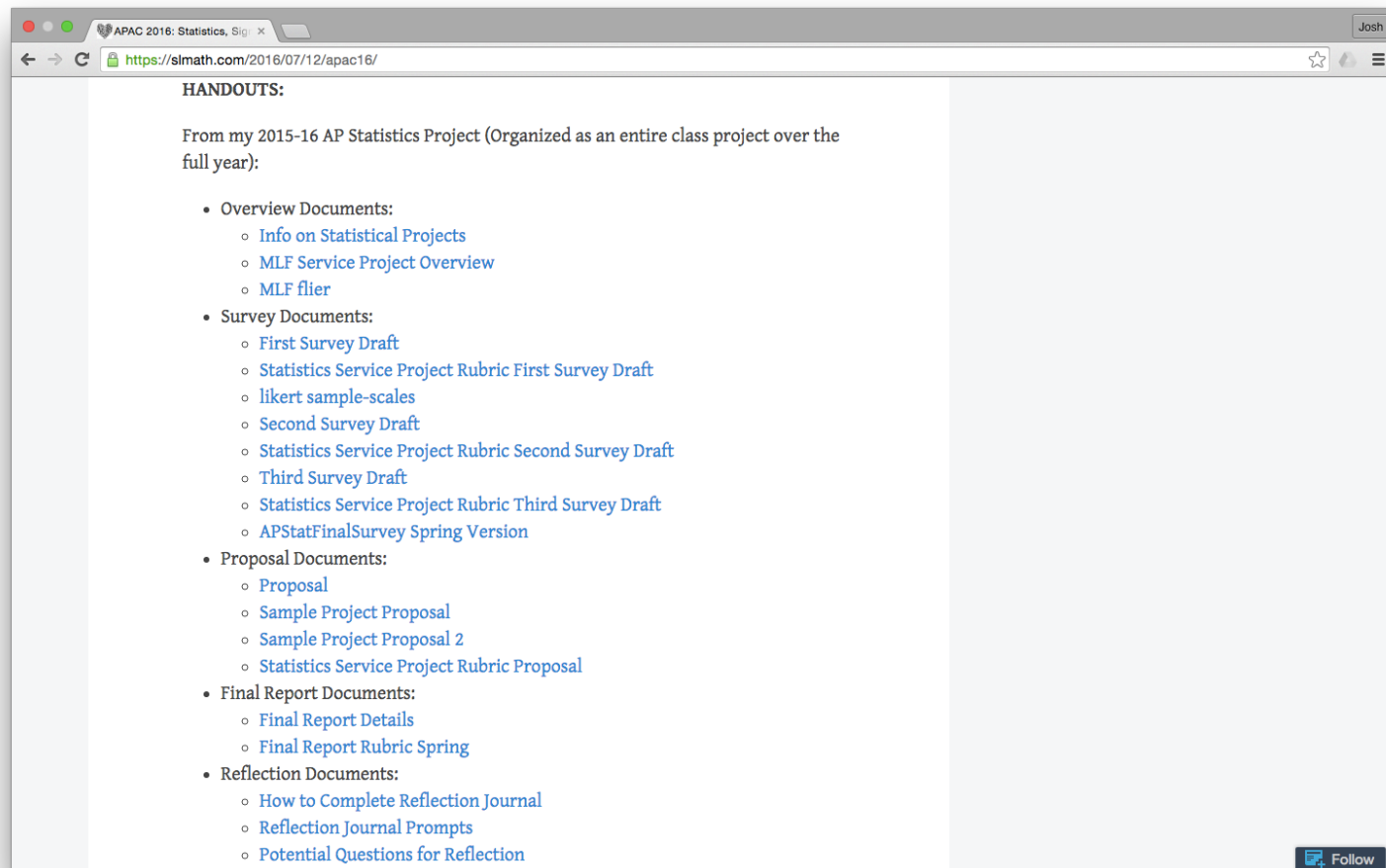
WHY Consider Service-Learning?

“Yeah, definitely, much more positive. It was hard, don't get me wrong and I'm not saying the ‘I'm no good at math thing’ didn't change, but I do think ... I am sure that I can learn it, because I am sure I can learn it. It just will take longer and when you don't feel so completely discouraged about it ... When you do feel that you do have shot to understand it and learn it, for me at least it really raises my attitude towards it. It doesn't feel like it's this hopeless thing that I just have to suffer through. It is kind-of just a hill you climb, right?”

III. HOW DO YOU IMPLEMENT SERVICE-LEARNING?

HOW do you Implement Service-Learning?

www.SLmath.com/NCTM17



HOW do you Implement Service-Learning?

Determine a community partner that has the time to communicate on a regular basis with you and your students and where students will be addressing a real community need.

- The community partner must be viewed as a co-instructor
- Discuss with the community partner:
 - The academic calendar the students are operating under
 - The difference between SL and community service
 - The learning objectives for your course
 - Deadlines for stages/completion of the project
 - Plan for final presentation of deliverables to all stakeholders
- Students already involved in community service can be an excellent resource
- In lieu of a partner organization you can also consider a general community need for students to address.

HOW do you Implement Service-Learning?

Organization: Large Scale

- Organization or cause selected by teacher or entire class
- Teams of students work on components
- More work for teacher but more reliability in community partnership
- Is every student involved in the entire mathematical process?

Organization: Small Scale

- Organizations selected by individual student teams
- Teams of students work on separate projects
- Organization is meaningful to students but questions vary
- Is every student involved in the entire mathematical process?

HOW do you Implement Service-Learning?

Timeframe: Spring Semester

- Students equipped on survey methods and data display during fall “mini-projects”
- Spring semester starts with meeting agency and writing proposal
- Data gathered by mid semester and inference procedures applied when taught
- Time between AP exam and end of semester? Write and present report

Timeframe: Year Long

- Fall portion of project starts with meeting agency and writing proposal
- Students write, refine, and administer survey in fall in conjunction with when unit is taught
- Data gathered in fall can be used as inference procedures are taught in spring
- Final report and presentation can take place prior to AP exam (or other end of year exams)

HOW do you Implement Service-Learning?

Reflection

“Service-learning in its most effective and well-developed sense is more than another name for ‘real-world learning’ and consists of more than applied work in the public/non-profit sector. It involves a multilayered reflection process that can substantially increase its educational value in a broad sense.... Service-learning reflection asks the learner to become more aware of what he/she brings to the learning process: values, assumptions, biases – many of which are unexamined and potentially problematic....To leave these aspects unexplored would be to miss a vital educational opportunity, for they invariably stir up thoughts and feelings highly deserving of reflection and discussion.”

- Zlotowski (2005) Zlotkowski, E. (2005). “Foreward.” In C.R. Hadlock (Ed.), *Mathematics in service to the community: Concepts and models for service-learning in the mathematical sciences*. Washington, DC: Mathematical Association of America.

HOW do you Implement Service-Learning?

Reflection

“Some people may think that this reflection process refers to a kind of ‘touchy-feely’ exercise that might be quite foreign to the mathematics classroom. I prefer to think of it as the processing of a rather complex set of experiences to assure that students share and solidify their insights and thus obtain maximum lasting benefits. This has actually been one of the most important contributions of the service-learning initiative.”

- Hadlock, C.R. (2005). “Introduction and Overview.” In C.R. Hadlock (Ed.), *Mathematics in service to the community: Concepts and models for service-learning in the mathematical sciences*. Washington, DC: Mathematical Association of America.

HOW do you Implement Service-Learning?

Reflection

- How often do you want to utilize it?
 - Should at least have a reflection pre-project, mid-project, and post-project.
 - Suggestion from literature is weekly to bi-weekly during the course of project
- Through what means will you utilize it?
 - Student notebooks
 - Handout with questions
 - Google doc
 - Other
- What will you ask or have students do?
 - Reflection on the statistical/mathematical skills involved
 - Reflection on the other skills/experiences involved

HOW do you Implement Service-Learning?

The image shows a screenshot of the Google Drive web interface. At the top left is the Google logo. To its right is a search bar labeled 'Search Drive'. Below the logo, the word 'Drive' is displayed next to the Google Drive icon. The breadcrumb navigation path shows 'My Drive > AP Stat Wilkerson > Reflection Journals' with a dropdown arrow and a profile icon. On the left sidebar, there is a red 'NEW' button and a list of navigation options: 'My Drive', 'Shared with me', 'Google Photos', 'Recent', 'Starred', and 'Trash'. The main content area shows a list of items under the heading 'Name ↑'. The items are: a folder 'C Block', a folder 'E Block', a PDF file 'How to Complete Reflection Journal.pdf', a document 'Reflection Journal Prompts', and a PDF file 'Same kind of different as me excerpt.pdf'. Each item has a corresponding icon and a share icon to its right.

Google

Search Drive

Drive

My Drive > AP Stat Wilkerson > Reflection Journals

NEW

My Drive

Shared with me

Google Photos

Recent

Starred

Trash

Name ↑

C Block

E Block

How to Complete Reflection Journal.pdf

Reflection Journal Prompts

Same kind of different as me excerpt.pdf

IV. WHERE CAN YOU FIND ADDITIONAL RESOURCES?

WHERE can you find resources?

- www.SLmath.com
- Forthcoming AP with WE service partnership?
- Issue of *PRIMUS* Dedicated to Successful Service Learning Resources (Volume 23, Issue 6, 2013):
<http://www.tandfonline.com/toc/upri20/23/6#.U4iSufldUmM>
- *Mathematics in Service to the Community: concepts and models for service learning in the mathematical sciences*, Charles Robert Hadlock (MAA Notes Series)
- Service-Learning Session from JMM 2011:
<http://www.math-cs.gordon.edu/~kcrisman/SLTalks/>

QUESTIONS?

What excites you about implementing a service-learning project in your class? Why do you think service-learning might be a good idea for your students?

What makes you reluctant to implement a service-learning project in in your class? What concerns do you have in undertaking such an endeavor?

Would you be interested in a longer, hands-on workshop that would aid you in designing and evaluating service-learning projects? (If so, please leave your email address)