Increasing Motivation and Creativity Through Service-Learning

Katalin Grubits, PhD

&

Lia Leon Margolin, PhD

Department of Natural Sciences and Mathematics

Marymount Manhattan College

New York, New York

Aims of Service-Learning (SL)

- Relate course material to real-life experience
- Provide a deeper understanding of material
- Encourage students to be engaged with their local community and become socially-responsible citizens
- Gain confidence in skills learnt in the classroom
- Clarify career choices

…and much more…

Aims of Service-Learning (SL)

- Increase motivation of students
- Develop the ability to communicate scientific ideas effectively
- Foster creativity, with a focus on expressing one concept in multiple ways

Outline

- Motivation and Creativity in the SL context
- Two models of SL in the curriculum
- Assessing Motivation and Creativity
- Outcomes
- Recommendations for a SL program that fosters scientific creativity
- Concluding remarks

Motivation and Creativity in SL

Motivation

- Enthusiasm for the course material
- Desire to continue studies in the discipline
- Willingness to repeat SL and/or course experience

- Some difficulties in assessing motivation
  - Many factors and components of the course influence the level of motivation
  - Students who choose to do SL are a self-selecting group
  - Frequently not enough students to get statistically significant results
  - Answers to questionnaires may depend on when administered

Motivation and Creativity in SL

Creativity

- Ability to express one concept in multiple ways
- Novel explanations and examples
- Imaginative methods used to communicate ideas

- Some difficulties in assessing creativity
  - Identifying the source of ideas (student vs others)
  - Having students recognize differences in explanations
  - Gathering evidence
  - Attributing origin of idea to one student of a group working together

Two Models of SL: 1. Physics Workshops

- Population:

  Physics for non-majors (second semester of introductory course)

- SL Model:

  Students taught science workshops at a local public elementary school

  - Planned experiments
  - Performed demonstrations
  - Created worksheets
  - Responsible for teaching concepts
  - (Elementary school teachers were responsible for the discipline of school students)

Two Models of SL: 1. Physics Workshops

- Logistics:
  - SL students taught one-hour classes (workshops) to elementary school students (4th grade)
  - Each workshop was repeated in a second hour for the other 4th grade class
  - SL was a component of the laboratory portion of the Physics course
  - Half of the semester's lab hours were spent doing SL

- Culminating event:
  - Elementary school students visited college lab and observed / investigated experiments performed by SL students in regular lab hours throughout the semester

Two Models of SL: 1. Physics Workshops

- Content:
  - Topics covered in 4th grade syllabus were compatible with material covered in Physics course
    - Thermodynamics → Properties of Water
    - Electromagnetism → Electricity and Magnets
- SL students taught science workshops in pairs
- Workshop topics were arranged at planning sessions before each unit (attended by SL students, 4th grade teachers, and professor)

Two Models of SL: 2. Mathematics Tutoring

- Population:

  Mathematics for liberal arts students (required Quantitative Reasoning course)

- SL Model:

  Students tutored public middle and elementary school students at afternoon / Saturday tutoring centers

  - Tutored mathematics
  - School students can come with any question related to their homework or other work
  - SL students in some cases had to devise new problems as extra revision or as extension
  - Tutoring may be done individually or in small groups

Two Models of SL: 2. Mathematics Tutoring

- Logistics:
  - SL students tutored for at least 10 hours during the semester
  - Attendance at the tutoring centers was optional so attendance of school students was highly variable
  - SL option replaced project-work in the Quantitative Reasoning class

Assessing Motivation

- Students more interested in learning concepts and examples that they could use in their SL workshops

- Types of questions they asked in class were more conceptual
  - What if … ?
  - How does … ?
  - Is that why … ?

But how do you assess motivation?

Assessing Motivation

- Testing: Pre- and post-SL questionnaires
  - all questions were answered on a scale of 1 to 5

  - Do you enjoy physics/math?
  - Do you plan to take any more physics/math courses?
  - How difficult do you find physics/math?

  - Would you recommend the SL option in this course to other students?
  - Do you feel more interested in science/math after participating in SL?

Assessing Motivation - Outcomes

- Do you enjoy physics/math?
  - Not really - slight increase in final responses
- Do you plan to take any more physics/math courses?
  - No - no change in pre- and post-SL responses
- How difficult do you find physics/math?
  - Quite difficult - slight increase in final responses
- Would you recommend the SL option in this course to other students?
  - Yes
- Do you feel more interested in science/math after participating in SL?
  - 50% Yes; 50% Same level of interest

N.B. Total number of students: 4

Assessing Creativity

- Testing:

1. Notebooks in which ideas for experiments/demonstrations are recorded

2. Journals in which students reflect on experiences

Assessing Creativity

1. Notebooks in which ideas for experiments/demonstrations are recorded

Student guidelines:

- Record ideas on experiments/demonstrations that could possibly be done in the classroom
- Explain why you chose the experiments/demonstrations that you did
- Explain the key concepts to be covered

Assessing Creativity

2. Journals in which students reflect on experiences

Student guidelines:

- Think of an example in which a student didn't understand something. Give examples of the different ways you explained the concept.
- What differences were there between your presentations to the two classes?
- How would you change your style of presentation for the next class?

Assessing Creativity - Outcomes

Sample journal entry:

(explaining why energy is needed to melt a solid)

"…think of the solid like a sheet of glass…to break bonds, energy needs to be put in…to break [the sheet of glass] into pieces you would need to exert energy therefore breaking the solid's close bonds."

- Evidence of making connections to real-life examples at an appropriate level for the audience.

Assessing Creativity - Outcomes

Sample journal entry:

(after discovering that some of the equipment provided did not work, while in front of the class)

"…we changed the lesson to talking about how sometimes in a lab things don't always work out as you plan them to. Part of an experiment…is to figure out why the results are what they are."

- Evidence of adjusting to a challenging situation on the spot and still providing a valuable lesson.

Assessing Creativity - Outcomes

Post-SL questionnaire:

- Do you feel more scientifically creative after participating in the SL component of this course?
  - Yes - 75% Somewhat - 25%

- Do you feel more confident in expressing scientific ideas after participating in the SL component of this course?
  - Much more - 75% No - 25%

N.B. Total number of students: 4

Other Outcomes - deeper understanding

Has the SL component of the course helped you to better understand the course material?

Strongly agree - 50%; Agree - 50%

- "Yes, when teaching the concepts to younger students it forces you to completely understand what you are talking about. Instead of memorizing concepts I was able to understand the "why" of many concepts."

- "Yes…when we're in class…we tend to just accept concepts as they are introduced to us and don't really challenge them. But [in the SL component] we not only had to know how to make these experiments but also had to know how it works and why. So, for me, it brought the learning to a greater depth than I had ever been used to."

Other Outcomes - communication skills

Do you feel that the SL component of the course has enhanced your ability to communicate ideas in a real-world context?

Very much - 50%; Yes - 50%

- "I was able to effectively and clearly teach the topics to the students. The way to tell if you learned something is if you can teach it to someone."

- "The most frustrating [aspect] was just conveying what we knew to the students in a way they could understand. I think I struggled with that throughout the semester."

Other Outcomes - benefit community

Do you feel that the work that you did through SL benefited the community?

Very much - 75%; Yes - 25%

- "I felt a state of euphoria come over me because I was proud that he was able to deduce [the correct] answer from the information that was explained earlier."

- From the elementary school teachers:

  "Thank you for making the collaboration…a resounding success. The entire experience was overwhelmingly positive…thanks for everything!"

Other Outcomes - benefit community

Questionnaires for 4th grade students:

- Do you like science?

Pre-SL:		Post-SL:	
Very much	- 35%	Very much	- 46%
Yes	- 35%	Yes	- 27%
Sometimes	- 24%	Sometimes	- 27%

- Do you like doing science experiments?

Pre-SL:		Post-SL:	
Very much	- 67%	Very much	- 73%

What works? Things to keep in mind

- Students need to take ownership of the SL
  - They were solely responsible for the workshops
- Plan the SL and make arrangements well in advance of the start of the semester
  - The logistics (format, dates and times, topics covered, etc) were all arranged with the elementary school teachers before classes
- Introductory meetings
  - Teachers coached SL students in appropriate teaching techniques
  - SL students, school teachers, and professor met at the start of each unit to plan topics and activities

What works? Things to keep in mind

- Maintain communication with your community partner throughout the semester, independently of your students

- A good community partner is invaluable!

  Are you serving their needs?

Our community partner:

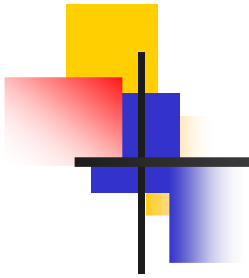
Previously an under-performing public school that was shut down and re-opened this year under new leadership.

Majority of students are minorities and many receive free or subsidized lunches.

SL students could add depth to the science classes taught by the elementary school teachers.

Students sat the state science test a few weeks ago - we are eagerly awaiting their results!

Fostering creativity



- Encourage questions in class that may seem like digressions
- How else could you explain this idea?
  - Explain it to a classmate
  - Role-play: one student pretends to be an inquisitive 4th grader
- How would you explain it to your family / younger sibling?
  - No equations allowed!
- Revisit questions

Concluding thoughts

If you think that service-learning is important and if you are enthusiastic, your students will be too!

Fostering creativity and emphasizing reflection helps students to become better learners in all of their classes.

Being able to explain concepts to family and friends empowers students and is a great motivator.

Concluding thoughts

If you think that service-learning is important and if you are enthusiastic, your students will be too!

Fostering creativity and emphasizing reflection helps students to become better learners in all of their classes.

Being able to explain concepts to family and friends empowers students and is a great motivator.

Thank you!

Contact: kgrubits@mmm.edu