Community Service-Learning in Mathematics: Models for Course Design

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Models for Implementation - Heffernan

- Instructors need to
  - Plan how service will be incorporated into their course
  - Think about how their course meets departmental objectives, the university's mission and the community's expectations
  - Address how a service component will meet their goals and their students' expectations
- Some overlap exists between the models

1. “Pure” Service-Learning

- Intellectual core is the idea of service to the community by students, volunteers or engaged citizens
- Not offered through any one discipline; often through service-learning or experiential learning programs
  - Bonner Center for Civic Engagement (U of Richmond)
  - Academically Based Service-Learning (Calvin College)

Pure S-L Examples

- *Community Service in American Culture* (Providence College): Students develop and implement a plan for rehabilitating a house; form several work groups (design, fundraising, etc.)
- *Introduction to Service in Multicultural Communities* (Cal State – Monterey Bay): Students work at a community health organization working to prevent communicable diseases.

Pure S-L in Math

- “Build” a multicultural, ethno-mathematics program or social justice math program at a local school
- Help start a Math Circle or similar program at a local school
  - Either of these would need planning, fundraising, advertising, etc. that students could do

2. Discipline-Based Service Learning

- Similar to Pure S-L but course content is the basis for reflection, analysis and understanding of service activities
- Includes a specific link between course content and community experience

Discipline Based Examples

- *Medieval Europe* (Sacred Heart College): Includes an option to do a student-teaching internship with sixth-graders at a local school (in place of a paper); present units on the medieval world, work with reading skills, and design and run projects
- *Composition* (Millikin University): students tutor in a local GED prep class

Discipline Based Examples

- *Environmental Science* (Allegheny College): students share the relevance and importance of their environmental sciences knowledge with culturally, linguistically, technologically, and economically diverse populations.
- *Linguistics* (Univ of Penn): After examining literary narratives, students write a narrative for the teaching of reading to African American children in grades 2-4, to motive children to read, using for cultural frameworks: hip-hop, traditional Southern, African-centered and Inspirational Gospel

Discipline-Based in Math

- *Math for Elementary School Teachers* (Portland State Univ.): “Math in the Park” – college students worked with high school students to design and conduct whole-body math games for inner city middle school students, to popularize mathematics

Discipline Based in Math

- Student teaching projects
  - Probability and statistics topics, such as producing and interpreting graphs and developing and using simple probability models
  - Geometry topics for a unit of mathematics and art, such as tessellations and perspective
  - Other courses such as linear algebra or discrete math that are being offered in high school
- Tutoring
  - Lawrence Math & Science Partnership (Merrimack College)

3. Problem-Based Service Learning

- Students relate to the community as a “consultant” working for a “client”
- Presumes that students have specific disciplinary knowledge to draw on to understand a problem and to develop a solution, thereby increasing the potential value of the service to the community.

Problem-Based Examples

- *Civil Engineering: Traffic Flow Theory* (Univ. of Utah): students work with community members to understand the problems, then design and present traffic solutions
- *Communication in Organizations* (Univ. of Utah): students complete a communication needs assessment for a local organization involved in disaster response and emergency management

Problem-Based Examples

- *Children's Television Production Workshop* (New York Univ.): students with a youth group to produce public service announcements for the Fearless Theater Company
- *Health of Women* (Brown Univ.): students identify, evaluate and summarize scientific research on topics related to women's health

Problem-Based in Math

- *Combinatorial Mathematics* (Univ. of Minn. – Morris): Students worked on one of three projects – traffic flow, placement of signs, or snow removal; part of a sequence of three courses addressing scientific analysis of Morris' population, economy, physical and natural resources, land use, housing, existing public utilities and circulation systems.

Problem-Based in Math

- *Environmental Issues: A Mathematical Approach* (Berea College): students study resource management and local/global issues; one example is the modeling of nerve gas resulting from planned incineration
- *Introduction to Statistics* (Univ. of Mary Washington) Students complete client summaries, program evaluations, and community surveys – for an introductory statistics course at UMW

4. Capstone Courses

- Courses designed for majors, typically offered to students in their final year
- Explore a new topic or synthesize students' understanding of their discipline
- Students create materials to demonstrate the analysis, synthesis and intersection of course work and service
- Transition from the world of theory to the world of practice

Capstone Course Examples

- *Junior Seminar in Environmental Solutions*: Students design a feasibility study for bringing an aquaponics facility to their local community
- Web Site Design and Management (San Francisco State Univ.): Students design and build fully functioning websites for a non-profit organization

Capstone Courses in Math

- *Mathematical Consulting* (Univ. of Redlands): Students work on projects for faculty and outside agencies; projects include analysis of bird count data supplied by the local Audubon Society
- *Pre-Teaching Summer Undergraduate Research Experience* (Georgia Tech): Students work with a high school teacher from the Georgia Interns Teaching Fellows program to conduct research and develop lesson plans

Capstone Courses in Math

- *Biostatistics with Applications in Global Health* (St. Olaf): students travel to World Health Organization to work on projects such as evaluating the global burden of disease
- *Engineering Projects in Community Service* (Purdue): students work in groups to solve engineering-based problems for local agencies

5. Service Internships

- Traditional internships with a reflection component
- More intense than typical S-L courses with students working 10-20 hours per week in a community setting
- Include regular and ongoing reflective opportunities to help students analyze their experiences using discipline-based theories.

Service Internship Example

- *Public Service Practicum* (Providence College): Prepares students to work as a Community Assistant for a public service institute

Service Internship in Math

- Center for Interdisciplinary Research (St. Olaf): offers fellowships for students to work on research projects
- Working at a local science museum (e.g., Science Museum of Virginia) to help update exhibits, plan and facilitate visits by local school groups

6. Undergraduate Community-Based Action Research

- Similar to an independent study but involves learning research methodology and servicing as an advocate to the community
- For students who are highly experienced in community work
- Effective for small classes or groups of students

Action Research Examples

- *Regional Economic Development Practicum* (Lehigh Univ.): Students participate in the design and execution of a research project identified by a local agency
- *Introduction to Archaeology* (Calvin College): Students research and assess the waste produced by the college community and provide data for improving disposal, recycling and composting

Action Research in Math

- *Unity College Lake Winnecock Water Quality Project*: Multidisciplinary project involving 17 SL courses (including Statistics II) that focus on 6 goals, such as monitoring water quality, developing outreach materials to educate and mobilize the public, and identify social issues that affect water quality
- Lawrence Math & Science Partnership (Merrimack College): students develop inquiry-based activities for middle school students

Co-Curricular S-L

- Not one of Heffernan's models
- Does not follow the traditional view that effective S-L occurs at the intersection of meaningful community service, enhanced academic learning and purposeful civic learning
  - S-L most prevalent in social and health sciences, disciplines that have created the definitions and guidelines
  - Concern about where learning occurs

Co-Curricular S-L in Math

- STATCOM (Statistics in the Community) (Purdue): a student-run organization that provides pro bono statistical consulting to local government and nonprofit organizations; has expanded to STATCOMs at other universities

References

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