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# The Story of a Service-Learning Project: Mathematics in the Park

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## SUMMARY

The following is a description of the development and implementation of a service learning project carried out at Portland State University. Besides describing the mechanics of the project, the description includes excerpts from student journals, reflecting their growth in the service learning process.

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We often lead dual lives: the academic life full of intellectual discussions, classes, and textbooks, and a personal life focusing on hobbies, sports, and children. My "two lives" had become increasingly divergent with esoteric research and graduate classes at Portland State University competing with gang-impacted foster children and spiritual quests at home. My decision to devote my sabbatical year (1994-95) to access issues brought these two lives together in a unique way.

It all started with a conversation with a friend a year before my sabbatical was to begin. I had been thinking about ways to promote the popularization of math during my sabbatical, and she was relating her plans for Saturday classes for children. When she mentioned the importance of whole-body movement, I had it! Outdoor mathematics-based games—the ideas started pouring in!

Mathematics research was the foundation: searching for the essence of a mathematics concept. An active game built from the essence of a mathematics concept allows an internalization of that concept (examples follow). Shortly after receiving this inspiration, the Corporation for National and Community Service announced the Learn and Serve America funding. There was my key to making the ideas reality—PSU students could enroll for credit in a service-learn-

ing class in which they would create and deliver games. One problem: at the time, such credit did not satisfy any requirements other than elective credits—would anyone enroll? In learning about other service-learning programs, I was introduced to the concept of two-tiered service-learning, in which a small group trains a larger "second tier" group to provide the service. Anticipating low PSU student enrollment, I located a teacher at Jefferson High School (an inner-city high school) willing to loan me two of her school-to-work classes once a week. The university students worked with the high school students to create games and then provided backup support when the high school students taught the games to students at nearby middle schools.

I was fortunate to be awarded funding from PSU's Faculty Development funds as well as some of PSU's matching funds to our Learn and Serve America award. Northwest EQUALS (Peggy Noone in particular) played a significant role in developing the Math in the Park piece of PSU's Learn and Serve America proposal; Northwest EQUALS also provided essential community networking.

Before the school year began, I met with the high school teacher, Susan Schenk, to come to an understanding of our partnership. Fortunately, she had already planned to begin these two classes with exercises to develop creativity. Since PSU's quarter began several weeks after the beginning of the high school's semester, our project would begin immediately after the classes completed the creativity exercises.

A week before we were to meet with her classes for the first time, I met with Susan during her preparation period in her classroom. Climbing the stairs to Susan's third-floor classroom, I found myself follow-

ing a pair of young men sporting six inches of boxers above their sagging pants tops and carrying on a conversation in Spanish. Oh, I thought, fortified by my life with foster children, what an experience this will be for the PSU students!

In the initial quarter of the Math in the Park project, I recruited only two PSU students: my work-study assistant Connie Johnson (joining the project as her work-study employment) and a young woman majoring in business. Our first meeting with the high school students occurred on a sunny fall day, and we taught them some mathematics-based outdoor games to give them the flavor of the project. To our surprise, they had strong objections to going outside: the grass was wet and they would have to clean it off their shoes, playing with a basketball might soil their clothes! Well, they grudgingly cooperated but spent 20 minutes afterward getting cleaned up. The positive side was that they were confident that they could design better games than the lousy ones we'd taught them!

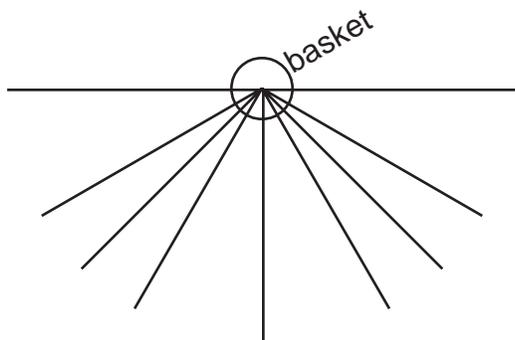
We divided the classes into design groups and set them to their task. Some groups came up with ideas immediately and some bogged down. Susan, with her enthusiasm and encouragement, kept everyone on task and suggested approaches. By the end of the first design session, each group had at least the outline of a game, and some had the game materials prepared and ready to go.

The first games created are among my favorites: Angleball and String Design.

**ANGLEBALL**

Tape is placed on a basketball court marking the angles  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $120^\circ$ ,  $135^\circ$ ,  $150^\circ$ ,  $180^\circ$  relative to the edge of the court.

Divide the players into two teams. When the game



leader calls out an angle, one player from each team races to the end of the line segment marking that angle. The first one to arrive wins the privilege of shooting a basket.

Besides reinforcing the concept of “angle,” Angleball teaches players to visualize these nine angles that arise frequently in other contexts.

**STRING DESIGN**

A group of players is handed a list of instructions, a ball of string, and a roll of masking tape. Following the instructions, they lay out the string, securing it with the tape. The result will be an outline of an object. For example, the following instructions result in the outline of a house:

- Go 10 feet
  - Turn  $90^\circ$  to the right and go 3 feet
  - Turn  $90^\circ$  to the right and go 2 feet
  - Turn  $90^\circ$  to the left and go 2 feet
  - Turn  $90^\circ$  to the left and go 2 feet
  - Turn  $90^\circ$  to the right and go 3 feet
  - Turn  $90^\circ$  to the right and go 10 feet
  - Turn  $30^\circ$  to the right and go 8 feet
  - Turn  $60^\circ$  to the right and go 8 feet
- (“Feet” can be measured with a measuring device or by using one person’s foot.)

Players get a chance to use the angles they learned in Angleball, as well as to internalize principles of measurement. In creating their own design instructions, they work through geometry concepts.

In the course of this design process, both PSU and high school students deepened their understanding of math concepts. In the design of Angleball, we watched one high school student teaching another how to use a protractor. They touched on radian measurement when they suggested marking the angles in fractions of a semicircle. In trying to design a probability game, the business major and her high school group struggled with the question of contexts in which probability is applicable.

After trying out the games on each other and on other high school classes, they made adjustments to the games and were ready to teach them to the middle school students. Well, we thought they were ready—actually, behind all the gang neighborhood bravado,

they were terrified! The day Susan's second period class was scheduled for their first middle school visit, only one student came to class. Fortunately, Susan had anticipated the problem and had recruited two honors students to assist with Math in the Park as their honors project. Eventually, more of the high school students joined us on outings to the middle schools, and we watched their self-esteem and confidence grow with each field trip. Their efforts to keep active sixth graders on task also gave them a new appreciation for the difficulty of a teacher's job!

Continuing the project into winter quarter, Connie and I were able to recruit six PSU students. The downside: most of them had schedules that didn't allow them to continue with Susan's classes. Consequently, we could only meet with Susan's second period class and had to find an afternoon class to work with. Jefferson High School's mathematics department connected us with Larry Pattee's general math class. Unlike the students of mixed ability in Susan's school-to-work classes, these students were homogeneously innumerate and undisciplined...but very creative!

The location and time of Larry's class required the PSU team to navigate Jefferson High School's halls at the end of the lunch hour. At that time, the floor is smeared with food and the halls are full of action: minor scuffles, major flirting, and insults filling the air. From PSU students' journals:

"Walking into Jefferson for the first time was like marching upstairs into the twilight zone. My 7th grader's school is much brighter and less hostile looking."

"I just observed how the kids interacted with one another. Gang hand signs seem to be a part of this community's language whether or not they are in a gang."

"I was shocked and dismayed at the amount of disrespect that goes on in the classroom. I found the students to be disruptive and rude."

"The kids were in complete and total control of the classroom. Not once did I even hear the teacher direct a statement to the class as a whole, and he left the room with a few students to go to the auditorium."

"Many awkward silences occurred while trying to get to know the two girls in my group. They were the only ones that showed up in my group today. Noralee was absorbed in a fashion magazine, and Shaleen was quietly sitting there waiting for me to do something."

And so we persevered through winter quarter, refining our strategies as we went. The "learning" piece of this service-learning project (beyond the obvious) was a weekly reflection meeting. Several of the students were taking education classes at the same time and were eager to relate their field work to their class work. Lively discussions ensued, based on politics affecting schools, school policies like tracking and desegregation, and societal attitudes about children from low income neighborhoods:

"Technology is changing our life at a pace never seen before, placing an ever increasing demand on our education system. To meet these demands, our education system must be flexible and designed to make changes as needed. This is not the current situation; bureaucracy has burdened down the present system, so that it can't adapt to current changes within a reasonable time span."

"Too many students are shuffled along the school system, failing to learn not because they are incapable, but they are not expected to learn."

"In just this one day at the school, I picked up more flaws in the school system than when I was a full-time high school student. To hear that teenage mothers are deprived of free day care to help them to achieve their diplomas saddens me. That was my first eye to eye interaction with budget cuts."

"Last quarter my thoughts revolved around the social structure that the Jefferson students were trapped in. A dark, dismal school surrounded by small, poorly maintained houses. The students seem to have given up. Why expend the energy to think when it didn't do much for their role models? What I didn't know is that the students last quarter had not given up. They just didn't have enough people

in their lives to tell them that dreams are attainable with work and time.”

“However, I realized one thing: in working with Jefferson High School kids, we need to treat them the same way as if they are of the same level. I feel they have more psychological problem than mathematical. That’s why if we can change their thinking and low esteem by treating them equally in terms of academic abilities, maybe they can improve their school as well as personal lives.”

“After a few slow rounds, I realized that there was a lack of self confidence around revealing an answer when a player wasn’t sure of an answer. Outwardly, the students called each other stupid in what seemed to be in jest. But inside, I had the feeling that those students had been called stupid by some influential peers.”

“How can I expect our education system to provide an equal education to all students when it is nested in a society that is already anything but equal? Some people believe that our current system is hindered by a ‘hidden curriculum’ that reproduces the existing social and economic class structure. In my utopian education system this would not be the case; students would be treated equally regardless of economic or social class. This would require a revamping of our current system where the privileged few have the advantage, and the poor are constantly oppressed. Herein lies the real paradox of education reform—if we break down the hidden agenda, we break down the very society we intended to serve.”

In the spring quarter, Susan’s classes were in the “work” phase of their school-to-work program and no longer available. Continuing with Larry’s class, we added Dave Dampke’s geometry class (our first high school class devoid of discipline problems) and ended the year with a collection of over 30 games, most of them having been field-tested.

Math in the Park continued as a service-learning project through the fall quarter of 1995, expanding in new dimensions. Connie, my work-study student,

wrote the instructions for 27 activities, and they were reproduced for dissemination. (These instructions are not in a very “polished” form yet, but you can order a copy from me by email.) During spring quarter, we included PSU students from Freshman Inquiry classes who had a service requirement, and they taught games in some after-school programs. Our predominant after-school partner was MESA (Mathematics, Engineering, Science Achievement), a program targeting traditionally under-represented middle school and high school students. The MESA director, Joan Kurowski, was very helpful in matching us with programs in several middle schools and in paving the way for us.

Based on my first attempt at community-based learning, I would emphasize two key components for success: a commitment by the community partners, and regular reflection meetings with the “service learners” (university students and high school students). Before the project started, I met with the first Jefferson High School teacher we worked with and discussed expectations. As schedules shifted and the project was “passed around” to other teachers at the high school, I was not able to set that groundwork, and the project did not proceed as smoothly in those classes. The university students’ weekly reflection meetings allowed them to sort through issues that arose in their work with the high school students and to examine the politics of public education in this country.

As I had hoped, the university students had formative experiences:

“I am still working on what approach I feel I should take with these kids. My first instinct is authoritarian, but as the kids start to warm up to me (and they are), my instinct changes. I think they just need to know that someone cares. And I think that I do.”

“I am a little bit confused with my emotions...I have never talked to a black person for more than 5 minutes. In my native country, The Republic of Georgia, we do not have any black people. And this was really an experience. I am surprised, though, that in the class of “Math in the Park” there was not more than one white kid! There was only one white girl...It’s funny, but I feel pleased that I went there. I think my last five-minute talk influ-

enced this emotion of mine. I talked with John, one of the students at Jefferson High School, and he showed his intellect as well as his heart.”

“I really have enjoyed this class overall, and it has really opened my eyes to what public school is like these days. Am I really cut out for this?”

Although racially Caucasian (with one exception), my PSU students were intriguingly diverse: majors in math, education, history, business, and engineering; the single mother raising a child with chronic health problems, the auto mechanic returning to college to make a mid-life career change, the recent immigrant from the former Soviet Union; childhood experiences ranging from extreme poverty in inner-city Portland to wealthy suburban environments. In the midst of this diversity lay a common commitment to creating exciting educational experiences for young people.

“I had a *wonderful* time playing with kids, I have to admit I did *not* think that it would be so much fun. Kids were really into it. I loved it. I even forgot that I was freezing.”

“I haven’t spent much time with people of different cultural backgrounds, and I was kind of afraid that I would say the wrong thing. Not to mention that I had no experience teaching students in a refresher class; the only tutoring that I had done had been with ‘gifted’ students who just needed a push in the correct direc-

tion. Thank heavens I was sadly mistaken; these students were great. I don’t know what I was so nervous about. They were curious and very interested in learning new things. It made me realize that it didn’t matter what level a student was at, as long as you presented a fun and interesting idea to them, they were more than willing to learn.”

“Jordan seemed to do a good job explaining the game while Shaleen did an outstanding job making sure everyone was doing the math correctly. Things really seemed to go well when students that were cutting other classes and hanging out with their buddies in our class wanted a score card so they could play. Believe it or not!”

For the past four years. Math in the Park as a service-learning project has been tabled as I have been repeatedly recruited to develop other exciting curricula. But it has a place in the future of PSU now that our new general education requirements are in place. I anticipate a revival of Math in the Park as a senior capstone project, which is now a requirement for all PSU students. Meanwhile, Math in the Park activities continue to be conducted by PSU education majors in their practica and by the after-school program AWSEM (Advocates for Women in Science, Engineering, and Mathematics).

What will I do during my next sabbatical? It will be hard to top the amazing experiences that occurred in developing Mathematics in the Park!

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“The secret to creativity is knowing how to hide your sources.”

--Albert Einstein

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