

# Los problemas ordinarios de la vida: Problematisaciones de las vidas de estudiantes

## (Ordinary word problems from the lives of students)

Jose Antonio Segarra, CPCS, University of Massachusetts at Boston, USA

In the College of Public and Community Service (CPCS), of the University of Massachusetts, Boston, adult students, ranging in age from 18-80, are being asked in the introductory course in Quantitative Reasoning, to reflect on and write about the issues in their everyday lives that they understand to be the most representative of them. Once students begin to develop a more meaningful sense of how mathematics is deeply involved in their daily lives, by this I mean within their concrete or lived understanding of how math permeates and influences their day-to-day decisions, I believe that they then are better able to construct a mathematical knowledge rooted in their *ordinary experiences*, so as to build their confidence in their own abilities so that they might begin to conceptualize and “do math.”

The range of issues that students present in their word problems<sup>1</sup> are as varied as the students that enter the classroom. There are students of different racial, national, cultural, ethnic, age and physically challenged backgrounds in the college, and in my classroom. At times, during the course of a class with such a variety of qualities as these, different qualities becomes salient for one or another reason. Mediating the tensions, attempting to create conditions where collective work in math can take place between that these qualities adds a dimension to the adult math classroom that is indeed challenging. The issues represented by their word problems are organically connected to the *‘living mathematics’* and are often better examples of math problematizations than any purchased or fabricated work that I as an instructor could purchase or manufacture. That is not to say that I don’t or haven’t relied on textbooks to help me generate or create my own word problems in my classroom, my point here is that I do not rely exclusively or even in great part on these textbooks. My classroom work relies heavily on the interplay of their experiences and bases of knowledge as well as drawing from my own experiences and knowledge, and from the learned interactions we generate within our classroom *‘culture of mathematics’*.

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<sup>1</sup> For Susan Gerofsky, word problems as a genre “establish a foundational narrative in our mathematical education’ because they ‘let us know what mathematics is allowed to be about, how we are to go about doing mathematics, and particularly, what is the uneasy relationship between the world of mathematics and our lived lives.” (Gerofsky,1999; p. iii)

Some examples of issues that emerge from the word problems of students have quite a range of topics and issues that go from: the increasing lack of time students have to themselves as they juggle between going to work, attending school, babysitting, traveling, studying and even walking the dog; for others the increasing cost of heating oil for poor working people and the elderly during the winter months in the Northeastern part of the United States and the economic, practical and possible life and death decisions one needs to make between staying warm, paying a mortgage and staying alive; even the most mundane acts of buying clothing on the internet when getting bored at work, and looking for the greatest possible discount on particular pieces of merchandise, sneak into the collective of word problems in this course.

In essence, the text of the class grows out of the work of the students and the teacher. The ‘*culture*’ of the mathematics we attempt to generate comes from a concrete understanding of what develops from our shared ‘*making sense*’ of our mathematized experiences. The ‘*ethno*’, in our mathematics draws from the constellation of ordinary experiences of the ways we live and how the world acts on us and how we develop ways in which to effectively act on and in the world. In a sense, this *culture of mathematics*, this *ethnomathematics*, within our classroom, is the product of the collective and collaborative work of students with a teacher to create an opportunity where each individuals’ work, worth, and math stories are equally valued and critiqued within an adult mathematics education learning and teaching context.

Within this emerging classroom *culture of mathematics* that develops over the course of the semester, each student is held responsible to the class, the collective, for making their own word problem clear enough for others to understand what is being asked from them to solve as well as developing an answer set that can be clearly followed by the instructor and any other student who sets out to figure out how to make sense of the outcome the word problem developer wishes the problem solver to solve.

Between the individual and the collective: The objective of my class is to attempt to create a balance between the independence of each individual students’ learning experience alongside the interdependence and responsibility of each student to the other, holding students accountable to each other to learn and to teach each other. Within this independent-interdependent dialectic we set out to create *math*.

### **Ordinary acts of learning: Developing a mathematics of the ordinary**

Why ordinary acts? When I say ordinary acts in this sense I mean to highlight the idea that the mathematical collective work of our students in their everyday work and life settings makes-up the body of work that exists in my math classroom. By having the ordinary acts of and within students experiences centrally representative of our working class students individual and collective work, we in essence attempt to problematize—we attempt to mathematize--the

complexities of their ideas and living work. I speak here of a *mathematics of the ordinary* as a response to Gerofsky's call to:

think in new ways about the nature and purposes of word problems, about their inherent oddness and contradictions, and about our rationale for using them in school mathematics programs, rather than simply, unthinkingly visiting them upon future generations of school children. (Gerofsky, 1999: pp. 54-55)

In essence this ordinary mathematical work seeks to mediate these contradictions by providing a concrete foundation of knowledge based in the ordinary and living experiences of the students.

### **Mathematics from the bones**

By mathematics from the bones I do not mean from the ancient Ishango bones of Africa. By a mathematics from the bones I mean the mathematics born of and within the experiences of students. That which is born in the marrow of the bones, that which is felt, lived and expressed. It also means those artifacts that students dig up from their experiences as having enough importance to them to be problemaized and then solved. When the experiences and 'stories' they problematize and solve have 'deep meaning' or has an intimate connection to their ways of being and acting in their lives, the mathematizing and problem solving strategies they begin to develop begins to make sense from their location in our process in particular and in their educational experience in general.

### **The process of creating ordinary word problems from the bones**

In the class students were responsible first for the creation for one of their own word problems. Secondly, they were randomly placed in six groups of five and then were asked to be responsible for working on solving and understanding the groups problems. Lastly, each group was responsible to each of the other 5 groups in terms of understanding and explaining each groups problems. The ideal I had in mind was that we create 30 word problems, and then that we collectively solve all of them as our final work.

### **The process of the ordinary problems from life**

With the ideal in mind that all the students in the class would be creating and then working on their word problems I set out to randomly assign all of the students into groups of 5. Each group was then assigned to develop particular types of word problems, using their lives as the basis or the template to tell their word or 'story' problem. I asked the groups to focus in on issues of statistical knowledge and concepts we had covered in our class, and also that their word problems needed to have or contain arithmetic and when necessary any algebraic processes that needed to be figured out by the problem solvers.

Over the course of seven weeks I worked on reviewing students word problems, returning drafts for them to work on and then finally compiling 26

word problems to be solved, including one of my own (four students continued working on their word problems until the end of the semester.) Students then in their groups of 5 were asked to begin solving the complete final product called the *Quantitative Reasoning Collective Work* packet. They were told that they could work together in their groups and collectively begin to make sense of the word problems, as well as ask the authors of each word problem for advice about the word problem if there was still any ambiguities or problems with the word problem. This process took the entire rest of the course, with some students successfully completing the work in anywhere from 5 weeks to 7 weeks. They were allowed to use calculators to try and figure out the problems.

### **The problems with the process with the ordinary problems from life**

In an ideal world things run smoothly with students working on developing and solving word problems, either individually or collectively. But, we can all agree that we do not live in an ideal world and inevitably the wonderful complexities of “real life” become all too apparent. The first problem we had to deal with was my *ideal* expectation that everyone should work together as a group. Not everyone in the class wanted to work together. Others believed that working collaboratively was a form of cheating and instead they considered themselves technically still part of the group but were still hesitant to share their ideas or findings with the rest of their assigned group or members of other groups.

A Puerto Rican student who was coming back to school after years of being away from formal schooling for example saw this exercise as an opportunity to share with others in working out the word problems. Not only did he finish the course ahead of the rest of his classmates, he also managed to help others work on their word problems weeks even after he had finished. A young deaf Black woman also managed to finish the course as we worked with her college-appointed translator, and she managed to quite successfully navigate collaborating with and helping her classmates work out the word problems.

An Irish-American student who has grown up most of his adult life in “Southie” a predominantly Irish-American working class neighborhood and had been away from school for 30 years worked well with the assignments. But one day an issue regarding race and a standardized test being given to high school students in Massachusetts, the MCAS (Massachusetts Comprehensive Assessment Test) came up within the context of how standardized tests are developed and what makes them “reliable” and he and an African-American woman almost came to blows as they exchanged some, shall we say, provocative, spirited and inflammatory phrases. Negotiating with each of them separately so that they might complete the course and learn to respectfully and critically engage each other, or not, was indeed a feat of intra-classroom diplomacy that gave me deeper insights into my own classroom style and technique.

Many of the stronger students in mathematics saw the students that needed more help as “cheating” off them. There were even a few students that did not work with the group at all and proceeded to work alone instead of collaborating with their classmates, and that was also acceptable. While I found this behavior a bit disheartening I allowed students the broadest array of possibilities to engage the material in the ways they found most fruitful; even though those ways seemed to go against my intentions as the teacher.

### **Some ordinary word problems from the lives of students**

The first word problem was developed by a student of Jamaican decent in the class. He was a fireman during the day and attended classes in the evening. When asked to problematize an issue or theme in his life he problematized his recent appointment in the Public Education unit of the firehouse he worked in.

My appointment within the Public Education Unit, in the firehouse became effective October 1<sup>st</sup>. Prior to this I was a regular Jake working fighting fires and doing medical calls for six years. My job now with the unit is to visit schools, grades K- 3, and senior citizens homes and talk to them about fire safety and prevention. Each group I speak to has approximately 25 people, and I speak to them for anywhere from 30 to 45 minutes. A group of volunteers also speaks to groups like these also. The talks I give usually have an introduction, a short film presentation, and then I have about 20 minutes of an open discussion, that includes questions and answers.

The total number of groups spoken to, by myself and the volunteers, from October 1<sup>st</sup> to November 29<sup>th</sup>, was, 75. From all of these groups we spoke to approximately 3900 kids and 475 adults.

1. What percentage of the people we spoke to were adults?
2. What percentage of the people we spoke to were children?
3. If I spoke to 125 groups and the group of volunteers spoke to other 50 remaining groups: a. What percentage of all the groups we spoke to from Oct. 1<sup>st</sup> to Nov. 29<sup>th</sup> did the volunteers speak to? b. What percentage of all the groups we spoke to from Oct. 1<sup>st</sup> to Nov. 29<sup>th</sup> did I speak to?

The next word problem was created by a Puerto Rican student that worked as a probate court officer for the city of Cambridge during the day. It is interesting to see what he believed were the most important issues to be problematized from his work.

While working at the *Cambridge Probate Court*, one of my daily tasks was to keep a Property Record Report. This report consisted of 7 items. These included: counting the number of people that entered the building, the total number of knives, guns, mace, misc, items, including the number of items we hold, as well as items that are unclaimed, and those that were illegal.

In the month of December, *Cambridge Probate Court* has a total number of 30,724 people that entered the front door, 166 knives, 24 guns, 10 cans of mace, and 256 misc., items were held. No illegal items entered (I hope.) Seeing that the court

is open Monday through Friday, the total number of working days for the month of December was 23. At the end of each year my boss likes us to estimate each item for the following year, and knowing that he only has 2 officers at the front door, he would like to know how many items each officer encountered throughout the year. If we use the numbers we counted from the month of December as an average month during the year: estimate the:

- a) number of people who entered the front door during the year
- b) knives
- c) guns
- d) cans of mace
- e) misc. items

An African-American woman created the following problem, during the time in the economy when many believed there were times of more jobs and prosperity ahead. She worked for the Department of Employment and Training and her problem dealt with determining the benefits someone who is unemployed is entitled to receive, as well as determining the case loads of case examiners in the department.

The economy is at an all-time high, and the unemployment rate is the lowest it has been in thirty years, at a steady 3.9%. Unfortunately, unemployment does exist and people that are out of work can file a claim for unemployment benefits right away. Within one week of the time a claim for unemployment is filed, you will receive your first benefit claim certification form. This form is used to report your status to the DET (Department of Employment & Training)

As long as someone is eligible for benefits, they will receive benefits every two weeks. Claimants receive a weekly benefit of approximately 50% of their average weekly wage, they earned when they were employed, up to a maximum amount set by the law. The current maximum benefit rate is \$402.00 per week. The maximum number of weeks a claimant can collect full benefits is 30 weeks. A claimant may elect to have taxes withheld from his/her benefits. The federal tax withheld would be 15% of the weekly benefit payment rate. The state withholds 5.5%.

Sometimes, claimants are disqualified from receiving benefits and are given a 10 day time period to appeal and are given the right to request a hearing. The hearing department processes 200 cases per month. These cases are distributed evenly among five Review Examiners. The review examiners make a decision as to whether or not a case should be affirmed, overturned, continued for further information, or dismissed. One-hundred cases are usually affirmed, sixty are overturned, 20 are continued for further information, and twenty are dismissed.

1. How much is the maximum benefit credit, if someone is entitled to the maximum weekly wage of \$402.00 for 30 weeks?
2. What are the total amounts of benefits someone is entitled to collect at the maximum weekly wage after the federal and state taxes are deducted?
3. What is the total amount of taxes deducted from the maximum unemployment benefit rate?
4. If there are 200 cases being processed a month by the hearings department, if

the cases are given out equally, how many cases is each review examiner assigned per month?

Lastly, an African-American woman working with the Regional Opportunity Counseling Program in Boston developed a word problem dealing with the limited resources that The ROC provides poor and working poor families in the Boston Area.

The Regional Opportunity Counseling Program, (ROC), expands housing choices for low income families with section 8 subsidies by providing them with comprehensive housing and counseling services and by generating rental listings for housing located in low poverty areas. The program is administered by The Boston Housing Authority/ Metrolist/The Boston Fair Housing Commission, the Metropolitan Boston Housing Partnership, in collaboration with six other Public Housing Authorities. The six partner PHA's are Brookline Housing Authority, Maiden, Peabody, Quincy, Revere, and Somerville.

Once the Section 8 voucher is issued, the voucher holder has 120 days from the date of issuance to lease up. If a lease is not in process by this time, the voucher is returned to the issuing agency.

If the Boston Housing Authority issues 200 vouchers per month, Quincy issues 50, Brookline issues 10, Peabody issues 2, Maiden issues 2, Revere issues 2, and-Somerville 20,

1) How many vouchers are issued by all 7 partner housing authorities in a month?

Of the vouchers issued, 70% of the Section 8 voucher holders find apartments in the allotted time of 120 days.

2) How many people use their vouchers?

3) How many vouchers are turned back into the housing authorities for lack of finding an apartment?

### **Concluding Remarks**

In my attempt to develop a classroom where the ordinary word problems from the lives of students emerge, something more important, in my opinion happens in the process. By creating a collaborative atmosphere where students can engage, be engaged, work together in creating word problems reflective of their lives and themselves as they develop an intimate understanding of mathematical concepts grounded in their living experiences, it is my belief that their learning mathematics becomes more than just another ordinary act. It was my hope that they see that together their ordinary acts and lives, and more importantly their working together on things greater than themselves constitutes as it always does an extraordinary act.

**References**

- Gerofsky, S. (1999). Word Problems as Genre in Mathematics Education. Unpublished Dissertation. Simon Fraser University: British Columbia.
- Frankenstein, M & Powell, A. (1998). Ethnomathematics. Albany, New York: SUNY Press.