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What if it were you?

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Abstract

Teaching Developmental Mathematics Courses to Community College students for more than seven years in New York City has given me the opportunity of experiencing many Aha! moments in my classrooms, one of which I will describe here. One of the beautiful and, at the same time challenging to teach, was: How to Solve Word Problems. What added to the challenge was the fact that the students were not willing to even try to learn how to solve those problems. They would tell me: This is so hard, I can't do it. I hate mathematics, that's why I am at the remedial math level. In this paper I explain how I was able to gain their attention and their willingness to learn, and, even like Mathematics.

Introduction

Since the Community Colleges today do far more than offer a ladder to the final years, and everybody is welcome, the students there come from diverse backgrounds. A well-fitted description of Community College is given in the title of the New York Times' article, By John Merrow, *COMMUNITY COLLEGE; Dream Catchers.* By writing the

story of four different students and the dreams they are chasing, he reveals the background of most of community college students. More than one third of the students indicated that *changing careers* was the major reason they were taking classes, some were *lifelong learners*, and some were part of *a harsh reality*, needing to take remedial courses several times. There were some that were doing *a smart transfer*, saving money. And since most of the students entering Community Colleges are not ready for college level courses, specially in Mathematics and English, he points out that Community Colleges are charged with doing the heavy remedial lifting, and they are now as much 10th and 11th grade as 13th and 14th.

I am trying versus I am getting things done.

Most of my students in developmental courses came from *a harsh reality* background. They went through High School with the idea that mathematics is a not understandable subject for most of the students. The first day of class I asked them to introduce themselves and tell us their major, and why they chose that particular major. I got answers like: *My name is Chris, and the major I chose is Social Services, because I want to make a difference in my community*. *I'm Janet, and I want to be a nurse, since that will give me a stable financial life*. *I'm Oscania, I'm studying Psychology because it has the least required mat*, etc. Enjoying their answers, I could read the dreams they were chasing on their faces covered by a fragile confidentiality. In my class were sitting the people with dreams that in a near future will change the world, and still they were scared of math. They were going to college, so they had done the first step toward reaching their dreams, and I felt it was my job to increase their confidentiality, and give them comfort that the math class will be doable and enjoyable. While going through the syllabus, I tried to convince them it will not be hard, and that they must believe on themselves and be willing to do the work. As the semester was going on, while checking their work, I could tell that some of them were just not working enough. When I asked them the question:

What was unclear that kept you from finishing this exercise?, most of the answers were: *But…, Miss…, I am trying…!* At that point I made it clear that there is a big difference between *trying* and *getting things done* and that the mentality that *if you at least try, you will be ok* will not help them succeed in life. I consistently reminded them about the help resources they can use to go from *trying* to *getting things done*, at least in the math class. I wanted them to understand and believe that if they put their attention on what they are doing and being willing to do the work, they will get things done.

I even read the poem *Don't quit* to them:

When things go wrong, as they sometimes will … Rest if you must, but don't quit.

What if it was you?

When I introduced the topic How to Solve Word Problem, I tried my best to explain the procedure they needed to follow to solve them. The procedure I use came from an online discussion group I was a member of Elementary Algebra instructors at Bronx Community College, led by Anthony McInerney, Assistant Professor & Chair, during Fall semester 2010. When teaching word problems we are teaching the problem of *translation* from one language, English, to Mathematics. And for most serious translations, the necessary tool is a dictionary. Even someone fluent in both languages occasionally needs to refer to one. So, the *English-Math Dictionary* is a very important part of the following procedure, by which one can consistently present the word problems in a step-by-step way:

1. Read the problem entirely and get a feel for the whole problem.
2. Make a *Dictionary,* which lists all unknown quantities and their units of measure in English and their algebraic translation next to it.
3. Translate the wording into algebraic expressions, and then combine them into an equation, equations, or inequality (rarely).
4. Solve the equation/equations.

5. Answer the question, which involves going back to the Dictionary and substituting, as well as discarding extraneous solutions (for example, negative numbers representing the length of a side of a triangle).

When outlining this methodology on the board, I emphasize: the only MATHEMATICAL step is the forth step. The others are translation steps. Using this procedure brings interesting discussions on one-variable versus two-variable approaches to problems. Using one variable to solve problems with more than one unknown quantity involves more effort in building an appropriate *Dictionary*, writing one unknown in terms of the other, and solving a single equation in one unknown, whereas using two variables makes the *dictionary* step easier, but involves solving a system of equations.

It was the second class we were working on *How to solve word problems*. Even though, I thought the students were appreciating the step-by-step way, not all were willing to master it.

I asked my students to work on the following problem:

Two buses leave Port Authority at 12 at noon. One bus travels east at 50 mph and the other travels west at 45 mph. What time is it when the buses are 451.25 miles apart?

As I was waiting for them to work on their own, I walked around and I realized that that not everybody was working. When I asked them why, some of them answered:

This is so hard, I can't do it. I hate mathematics, that's why I am at the remedial math level.

No one was able to answer it. Then I asked them what if it was you and your friend driving toward each other? It is 12noon, you are 365 miles away from each other, you are driving with 45mph and she is driving with 60mph. What time are you going to meet?

And … this was the time when the Aha! Moment took place.

One of the students said, *In this case I can find it out without using math.*

I asked him to come and explain his *non-math* way on the board for everybody.

He started by drawing a picture describing the situation as follows:

After an hour, at 1pm, we will be apart 105 miles less then at noon, at 2pm we will be 210 miles closer, and after three hours, at 3pm we will be only 35 miles apart. So we will and up meeting around 3:30pm. When I asked for the exact time one of the students answered: at 3:20pm. I asked her to explain why, another one said because in 20 minutes, he, (referring to the student in front of class), will do 15 miles and she will do 20 miles. At that moment I realized that the question: *What if it was you?* was magical; everybody in class was involved, paying attention, and trying to figure out other word problems. I asked the students why did he call his way of solving the problem *non-mathematical* he answered *because there is no equation involved*. Spending that class time matching *their way* with the *mathematical* one, and showing them that the equations are just mathematical translations of English statements made the students able to follow the procedure without memorizing it. They were able to *Read the Math* they were using, leading to creating the *Dictionary*. The fact that he started by finding out how much the distance will be shorten in *one* hour, and what we need to know is the time they need to travel to meet, x - the amount of time in hours needed to travel in order to meet, and the equation $110 \text{ miles/hour} * x \text{ hours} = 365 \text{ miles}$.

We solved it and …*Aha*!… we got the same answer, taking care of converting the decimal expression of the time into a sixty-minute system. Everybody understood what was going on. It was not hard for them to write an equation to solve the previous problem. They were able to follow the procedure without memorizing it.

The way we solved that problem helped me gaining their attention, and their willingness to learn the mathematics hidden behind their intuitive reasoning. Through the years I have been lecturing by using the question *What if it were you?* in real life situations, which always resulted in more student involvement and attention. Mastering the information through a question-and-answer process helps leading the students in the proper direction to reach correct conclusions without always providing the answers. Challenging them by presenting materials and constructing assignments in a way that

engages students to apply their knowledge in new learning situations allows them to share the excitement of discovery.

References

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