Chapter 7

William Campillo: Writing Linear Functions

I worked as a graphic artist for several years before changing careers. I originally used my knowledge of the graphic arts to work with teachers and schools around publishing student work. This led to a chance encounter with an alternative certification program in middle grade mathematics. Since then I have taught mathematics and recently added certification in middle grade science.

A course in environmental science changed my outlook and refocused my purpose as an educator. Since then I have tried to integrate themes into my teaching that touch on such issues as our local ecosystem, alternative energy sources, urban farming, climate change, population growth and natural resources. I am currently coordinating an International Baccalaureate program in a Chicago Public School with the goal of spreading these same themes throughout the school.

Writing Linear Functions to Predict Expenses

Grade Level: 8th or 9th

Content Area Topic: Mathematics

Content Area Standard(s):
- CCSS.MATH.CONTENT.8.F.B.4: Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph.

Learning Objective(s):
Create a linear function from a real world relationship between variables (number of units used vs. cost of those units) to determine cost of an item or a service.

Suggested Time Allotment: 1 hour

Sequence in Learning:
The unit inquiry statement suggests that important personal economic decisions can be made with the help of linear functions. A general introduction to functions and practice with simple linear functions has occurred in previous lessons. The warm up problem is a review of these ideas and leads up to the lesson. After this lesson, students will continue to work with linear functions that can be used to predict most expenses for their family. The goal will be to combine functions for average monthly expense that will help to determine what is the minimum income needed to cover support the typical household from their community.

Materials & Resources Needed:
Student instructions for activity are on last pages of this document. They can use calculators to help find answers that involve computing fractional percentages. When student continue with the secons part of the lesson they will use links to the websites for power and natural gas providers. These links, listed below, explain how the monthly bills are calculated. Students will use this information to write functions that will compute cost of using these utilities for any number of units.

Commonwealth Edison
https://www.comed.com/customer-service/billing-payment/
understand-bill/Pages/residential-bill-front-archive.aspx

Peoples gas
http://www.peoplesgasdelivery.com/home/gas_rates.aspx
http://www.peoplesgasdelivery.com/home/reading_bill.aspx

Lesson Activities & Sequence:
• Students will review creating functions from a description of a relationship between variables. A discussion of the warm up problem connects back to the context of the big ideas of the unit: What is a living wage?
• First students will work together to practice creating a function involving purchasing an item with sales tax. With this modeling, students are guided to the second part of the task - writing a function to express the cost of using electrical and gas service.
• There are two parts to this stage – one is to write the function, the other is to determine how many units will be used based on the relative size of the space and the number of people using the space. The second part is an extension that involves measurement of living space, an assessment of power usage, and other variables which may factor into the cost. A significant amount of research will be necessary to determine how much the cost should be. This will require a group effort and extended time searching the internet .

Proficiency:
Students will write and explain the parts of their linear function. They will use this function to calculate the costs for an item purchased in Illinois with sales tax included, or for extended learning, they will write a function to compute the cost of a utility given number of therms or Kilowatt hours (units used to determine amount of gas or electricity that has been used).

Feedback

Teachers As Learners:
Teachers who participated in this lesson thought the introduction was powerful in that the real life problem engaged students in a powerful way. The resources were effective additions to the lesson. The warmup combined with introduction helped to support the learner in approaching the problem. The unit has connections to a number of issues many students will face in the near future.

Elements of Pretty Good Practice:
The lesson includes modeling and activation of prior knowledge as well as extensions for advanced students. The context of the lesson is familiar to students and creates a connection to student knowledge. There is also a cross curricular connection to humanities, labor history (an 8th grade topic), and current events. Reading is also an important aspect of the lesson that can be integrated across curriculum. The lesson, as part of a longer unit, also contributes to students' consumer education.

Modifications and Adaptations:
• The lesson can be designed as a cooperative learning experience, allowing for all skill levels to participate.
• The general concept can be applied to a number of different contexts allowing students to solve problems to different situations that arise in daily life
• The resource materials can be adapted to different levels of literacy or languages.

Questions Arisen:
• How would you address the use of technology?
• When to make the decision to use paper-pencil as opposed to a calculator?

Peer Feedback:
The exploration part of the lesson may require more time or support. This can happen in a number of ways including teacher guidance, additional examples, scaffolding toward the more complex computation. The lesson can also be broken into two or more lessons to help reach the objective

Related Resources/Ideas:
Bellringer:
Pablo is very happy that he found a job at Dunkin Donuts. He was offered $8.50 an hour and told that he would be scheduled to work 30 hours per week. Now that he has a job he wants to move out of his house. He has been looking at an apartment for rent in the neighborhood, but he is not sure if he can afford the $800 per month rent. Can you help him decide?

Utilities calculators
• http://www.allconnect.com/lp-gas/natural-gas-usage-calculator.html
• http://www.kylesconverter.com/energy,-work,-and-heat/therms-%28u.s.%29-to-cubic-feet-of-natural-gas

Minimum wage info
- http://www.chicagotribune.com/business/ct-minimum-wage-chicago-0713-biz-20140713,0,3556102.story
- http://www.dol.gov/whd/minwage/america.htm
- http://www.minimumwage.com/in-your-state/
- http://business.time.com/2014/02/28/an-animated-history-of-the-minimum-wage/
- http://www.dol.gov/whd/

Comparing corporate profits
- http://www.nytimes.com/2014/04/05/business/economy/corporate-profits-grow-ever-larger-as-slice-of-economy-as-wages-slide.html
- http://www.huffingtonpost.com/2013/10/01/real-wages-down_n_4023869.html

Videos
- http://business.time.com/2013/08/29/fast-food-companies-can-afford-to-pay-their-workers-more/
- http://thinkprogress.org/economy/2014/04/11/3425609/walmart-prices-food-stamps/
- http://www.youtube.com/watch?v=vAcaeLmybCY
- http://chicago.cbslocal.com/2014/05/15/chicago-fast-food-workers-part-of-global-protest/
- http://www.theguardian.com/world/video/2013/dec/06/chicago-fast-food-strike-minimum-wage-video

What is the cost of living? (**Part 2 of 3**)
We have been using linear functions to calculate costs for services and purchases of different types of items. What does this have to do with a minimum wage? If we look at some of the expenses that provide us with the basic services we all need, then we can determine how much money we must earn to be able to pay all of those expenses on a monthly basis.
We will use a function to calculate the cost of a typical item you might purchase at any store.. You want to buy a pack of gum. You want a big pack that will last a few days.

This box of gum costs only $9.99
But that won't be the amount you pay. Why not?
Use the link below to find more information.
http://www.sale-tax.com/Illinois
What will the total cost be?
Talk with your group and decide on a function for cost C(x) where x
represents any item you want to purchase.
Write your function below.
C(x) = _____

Calculating the cost of Utilities
Let us get back to the topic of living expenses. Two major expenses
that we must cover are <u>electricity</u> and <u>natural gas.</u>

Break up into pairs, then decide which pair will work on electricity cost
and which will work on natural gas costs. Use the resources below to
write a function that will calculate the cost of electricity or gas.

Commonwealth Edison
• https://www.comed.com/customer-service/billing-payment/
  understand-bill/Pages/residential-bill-front-archive.aspx

Peoples gas
• http://www.peoplesgasdelivery.com/home/gas_rates.
  aspx#chargesInvolved
• http://www.peoplesgasdelivery.com/home/reading_bill.aspx

**Extension: Go back to the warm up problem and decide if
Pablo can still live on his own.**