
Math Across the Curriculum 3

Clothes Washers life cycle - Cost and environmental performance

Everett Community College

Intermediate Algebra | Christopher Quarles • Green Purchasing | Miguel Hernández

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Abstract

This report describes the cross-disciplinary approach used by two groups of students from Everett Community College working together in order to numerically evaluate and compare the cost and environmental performance of different clothes washers in the market. The two classes involved were Intermediate Algebra and Green Purchasing.

Intro and Overview

- The Green Purchasing class provides learning experiences that help business students consider environmental and social impacts on top of traditional purchasing/procurement criteria when considering the acquisition of goods and services for an organization. Such decision process involves multiple environmental variables that should be considered as integral part of the standard purchasing process. While they have solid knowledge of the combination of variables to consider in their evaluation, choosing the best performing product demands a level of mathematical complexity beyond their capacity.
- The Intermediate Algebra class is a standard algebra class that focuses on algebraic manipulation, reducing radicals, solving & simplifying different types of equations, and the like. Traditionally, there has been no applied content in this class beyond a smattering of the standard word problems.

Teaching and learning activities

Activity	Intermediate Algebra	Green Purchasing
1. Initial research and preparation		<ul style="list-style-type: none"> •Using the Energy Star website, each student picked three different clothes washer models of similar size. •Research life cycle costs and environmental impacts during use.
2. First team interaction	<ul style="list-style-type: none"> •Received visit from Green Purchasing students. •Discussed follow up questions . 	<ul style="list-style-type: none"> •Reported some life cycle components: <ul style="list-style-type: none"> •Cost: Retail price, water, sewage, electricity. •Environmental impact: Water use, electricity use, capacity, CO2 emission factor for local utility.
3. Calculation and reporting	<ul style="list-style-type: none"> •Created equations using real data to which had inputs specific to the washer, and outputs the Environmentally Preferable Purchasing criteria: <ul style="list-style-type: none"> •Cost •CO2 emissions 	<ul style="list-style-type: none"> •Provided follow up and assistance, if necessary.
4. Second team interaction	<ul style="list-style-type: none"> •Reported findings (calculations and graphs) to Green Purchasing counterparts. •Requests final verdict and signature. 	<ul style="list-style-type: none"> •Reviewed findings and decided on a winning product. •Signed off results.

Activity	Intermediate Algebra	Green Purchasing
5. Final submission	Professor Chris Quarles reviews mathematical accuracy and quality of work.	Professor Miguel Hernández reviews overall consistency and quality of work.

Resources

- [Energy Star website](#) for environmental performance and selection of certified clothes washers.
- [Amazon](#) and [Retrevo](#) for retail prices.
- [Snohomish PUD](#) for electricity, water rates and CO2 emission factors.
- [Everett Public Works Department](#) for sewage costs.

Teachers notes

Christopher:

- The algebra students had an opportunity to see equations which represented very real values. For instance, the price of electricity and the amount of CO2 emitted per kilowatt-hour used were coefficients in equations.
- There are a lot of teaching opportunities when you combine math with something concrete like buying a washing machine. For example, a number of students mistakenly made the cost of electricity 100 times larger than it was. This led to an interesting discussion about how the price of electricity would affect the purchasing decision. If electricity was \$8/kWh, we would all buy the most efficient washers possible.
- The quality of student work varied quite a bit. Generally, they were fairly savvy with Excel. It would be extremely reasonable to make the spreadsheet a required part of their grade. Before they get into the project, it's important to allocate class time to discuss the

basics behind life-cycle cost and CO₂ emissions. If feasible, it would also be a good idea to have students turn in rough drafts.

- In retrospect, clothes washers weren't the best choice of item. The lifetime cost of electricity is fairly small when compared with the purchase price of a washer.
- The primary push of the worksheets is getting them from the raw ideas of life-cycle cost to actual formulas, spreadsheets, and graphs. The project could be ramped up so that the students have to turn in a complete, professional-looking report rather than a combination of worksheets. It depends on how much time & willingness you have.
- This project could be done in an algebra class if your college doesn't have a Green Purchasing class. However, this would require quite a bit more knowledge about life-cycle analysis on the part of the instructor. It would require a bit more legwork as well.
- My favorite part of this project was telling students to use their own judgment, for example in deciding what factors to include in life-cycle cost or whether to use the local or national electricity-based emissions rates. The looks on their faces was priceless. In standard mathematics courses, we don't give students enough opportunity to relate their mathematical experiences with real-world decision making. We can do this by either having the students make (non-black/white) decisions which they use to create mathematics or by using the results of their mathematics to make decisions (like which washing machine to buy). This project does both of those.

Miguel:

- This was a great opportunity to understand the complexities of creating sustainable products in the business world.
- I underestimated the level of preparation and formality that such project requires in order to have the best possible learning outcome.
- Some variables that I need to consider and study in the future are: both classes should have similar student numbers, similar schedules (day and time) and the students need to have some form of common preparation before meeting for the first time so that their expectations about each other are realistic. Some tools that can serve this purpose are: questionnaires, checklists, readings or videos.

- In general, this was a tremendously successful assignment with great potential for improvement if it is to take place again. I am looking forward to new projects with Professor Quarles' students.