PBL Unit Design and Outcomes

Title of the Unit
Geometry of Portion Size
Mariola Sobol

Synopsis of the Problem
(What is the Topic? What is the context/situation? Who will pose the problem? What is the learners' role?)

The topic of the PBL Unit is obesity. The focus of the project is portion size offered by the high school cafeteria. Students will investigate whether the offered portion sizes comply with the USDA recommendations stated on the myplate.gov website. Incorporating geometry, such as area, surface area and volume, students will prepare presentations and poster boards with their research. They will present their findings to freshman biology students during an Obesity Forum, which will be the kick-off day for their PBL Unit focusing on the nutritional content. Associate Principal Ken Stiff will pose the problem in a letter addressed to the students.

School Faculty/Staff Partners—(names, titles, grade levels, content areas)	**Role in PBL Experience**
Mariola Sobol – sophomore geometry teacher Kathy Konyar – biology teacher Shannon Chambers – biology teacher Nancy Heintz – math/science division head/biology Ken Stiff – associate principal Laz Lopez - principal	Mariola will be facilitating the Geometry of Portion Size project with two sophomore geometry classes. Kathy Konyar will be the leader of the overall PBL experience for the biology students. Shannon Chambers will be the coordinating the cross-curricular experience between math and biology. Nancy, Ken, Laz will be providing the administrative support during the PBL Unit.
Industry/ Community Partner(s)—(names and titles)	**Role in PBL Experience**
Amy Yahiro – Dietetic Intern, Jr. VA Hospital Christine Zars- Registered Dietician; Northwest Community Hospital's Wellness Center	Amy will serve as an expert for the geometry students and will give feedback on their presentations. She will also present nutritional recommendations for high school students. Presenter – will give a presentation on the USDA recommendations and facts about obesity during the Obesity Forum to all of the students.
Learners—(Classes, Grade Levels)	**Role in PBL Design or Implementation**
Sophomores: Honors Geometry Students – presenters Freshman: Biology students – participants of the Obesity Forum.	The geometry students will present their research regarding portion size to the freshman biology students during an Obesity Form at WHS.

STEM-Related Career Awareness	
Featured STEM-related Careers Dietitian, Nutritionist, Biochemical Engineer,	**How is awareness of each career raised? How will growth be assessed? (Reference and attach sample artifacts.)** Nutritionist will visit the class and talk about various career opportunities in the health field.
21st Century Skills (or NET-S: National Education Technology Standards)	
21st Century Skill or NET-S Standard: - Health awareness - Working cooperatively with others - Thinking creatively and problem solving - Information/media literacy - Communicate Clearly and Collaborate with others - Leadership/Time management	**How will growth be assessed? (Reference and attach sample artifacts.)** Students will work in groups of four. They will devise a timeline with goals, objectives and tasks assigned to each group member. They will utilize the web-based presentation tools, power-point software, Flip camera during their project. They will prepare presentation that they will share with other students. Students will educate themselves on the various aspects of health, diet, nutrition and activity choices based on their research. Students will be assessed using a common rubric for their presentations. (rubric attached)

Learning Standards

Common Core Mathematics, Common Core ELA (Science Literacy), and ILS for Science or AAAS/NSTA Standards

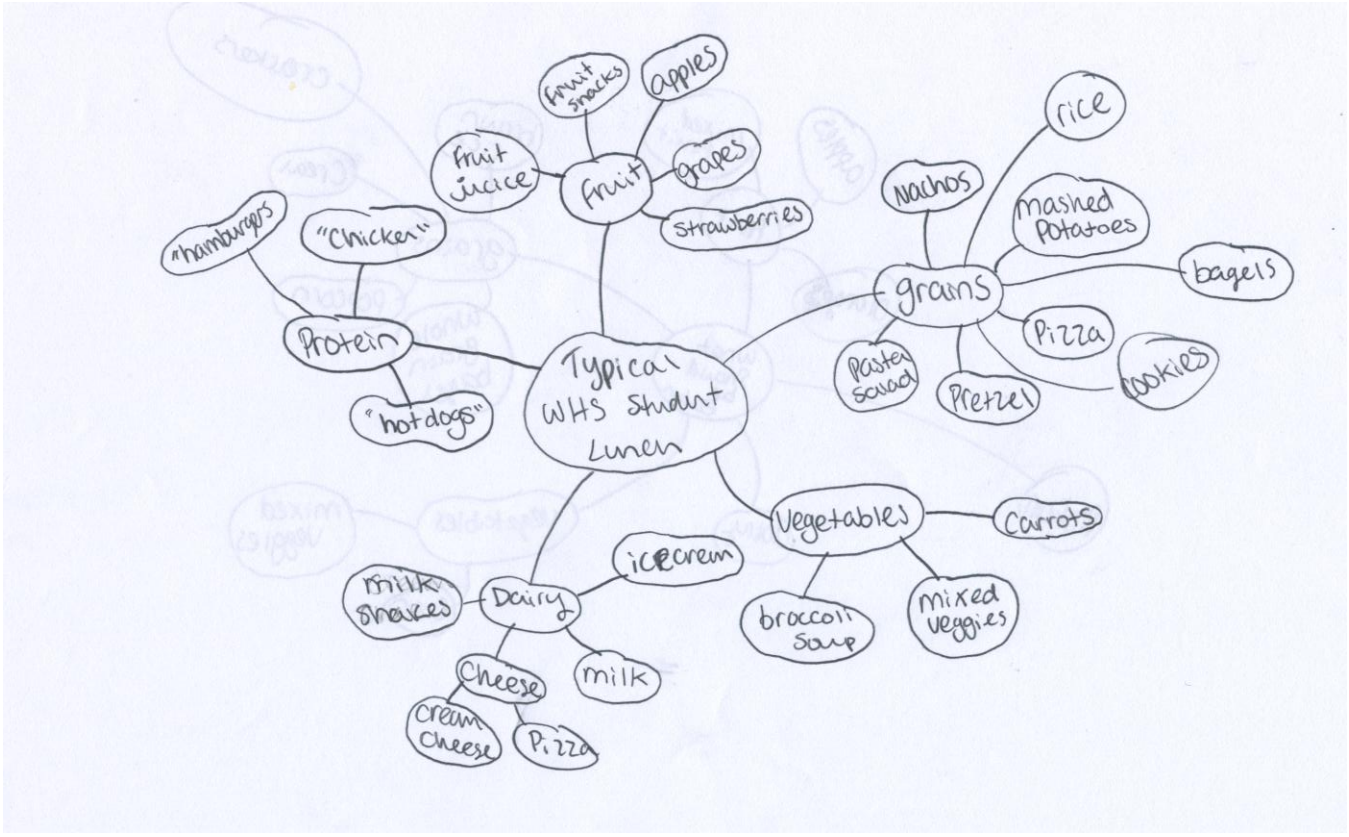
Standards	How will growth be assessed? (Reference and attach sample artifacts.)
• G-GMD.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	Students will calculate the area and volume of the lunch tray. Students will take a short quiz on finding the area of polygons.
• G-GMD.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★	Students will calculate the area and volume of the lunch tray. Students will take a short quiz on finding the area of polygons.
G-GMD.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	Students will calculate the area and volume of the lunch tray. Students will take a short quiz on finding the area of polygons.

Anticipated Concept Map of Problem

Students will most likely include: soda, pizza, Gatorade, burgers, fries, steamed vegetables, pasta, choc. Chip cookies, milk, Cheetos, Doritos etc.

Actual Student Concept Map(s) of the Problem

(might include early and final maps and/or different groups' final maps)



Anticipated Problem Definition

(How do you think the learners will define the problem?)

What is the TASK? (What are they being asked to do? Include their role and the situation--who is asking them?)

In order to determine whether the portion sizes offered in the school cafeteria comply with the USDA recommendations made on myplate.gov, students will investigate the geometry of the school lunch tray, the nutritional content of a typical lunch menu, and the choices made by WHS. The school administration is addressing the issue of growing obesity rates among teenagers in the US and would like to educate the WHS population through a Cross-Curricular Diet Awareness Campaign.

What are the factors do they need to take into consideration?

They need to consider: *choices made by students on daily basis, USDA recommendations on a healthy diet, lunch options provided by the district, geometry involved in the portion size as determined by the lunch tray available at school.*

Student Final Problem Definition

In order to …

In order to promote healthy nutritional habits of the WHS population, we want to educate students about the USDA recommendations for portion size and nutritional content for a typical lunch meal. We want to investigate whether the lunch menu complies with USDA recommendations and determine what choices the students are making now, and make recommendations that will make their lunches healthier.

We need to consider: *what is available in the cafeteria, what students are choosing from the menu, how does the lunch tray compare to the portion sizes recommended for teenagers;*

The Problem Challenge Artifact

(How will the problem be introduced to the students? Attach/insert actual artifact.)

Associate Principal wrote a letter to the students explaining the obesity problem in the U.S. and how it could apply to the WHS population. He asked students to investigate the trends at WHS:

To: Wheeling High School Student Research Teams
From: Ken Stiff

Obesity in the United States has been increasingly cited as a major health issue in recent decades. While many industrialized countries have experienced similar increases, obesity rates in the United States are among the highest in the world with 74.6% of Americans being overweight or obese. Estimates have steadily increased, from 19.4% in 1997, 24.5% in 2004 to 26.6% in 2007, to 33.8% (adults) and 17% (children) in 2008.

The direct medical cost of obesity and indirect economic loss to obesity has been estimated to be as high as $51.64 billion and $99.2 billion in 1995, respectively; this rose to $61 billion and $117 billion in 2000. Researchers for the Centers for Disease Control and Prevention and RTI International estimate that in 2003, obesity-attributable medical expenditures reached $75 billion. These statistics are alarming and have caused state and federal lawmakers to take notice. Much of the debate over how to address the problem has focused on schools.

Here at Wheeling High School, many changes have taken place regarding the availability of foods to students as a result of this problem. The State of Illinois has put forth guidelines for foods served in schools. These guidelines affect what WHS provides in a wide range of venues from the formation of lunch menus to the foods available in our vending machines. Despite these changes, we are still uncertain as to whether our students are choosing to purchase foods that are supplied by the school. If an individual chooses to eat foods purchased here, we have little data to tell us what foods students are choosing to purchase and whether those foods comply with the USDA recommendations. We are also unaware of whether necessary major nutrients, such as carbohydrates, proteins, and vitamin C, are missing from their lunch and whether lipids, a concern because of their high calorie content, are present in the typical lunch of a WHS student.

We would like for your research group to provide us with answers to these questions so that we have the profile of the dietary choices made by Wheeling Students on a typical day. We would like these answers to be presented to the WHS population in an awareness campaign before the end of the semester that will either applaud their wise choices or suggest that students change their habits.

In an effort to help you with your initial research, you will be attending an obesity forum tomorrow. The information and research that is presented to you will help you to gain some perspective on the problem at hand.

Sincerely,

Ken Stiff
Acting Associate Principal
Wheeling High School

Anticipated "Knows" and "Need-to-Explore" Lists

(Can use a variety of thinking routines, but be sure to include a list of what they "Know"—routines to use include: Know-Need to Know, Know-Want to Know-Learned, Observe-Think-Question, See-Think-Wonder, Think-Puzzle-Explore)

KNOWS	NEED- TO - EXPLORE
- Area formulas for basic geometric figures: square, rectangle, triangle, circle - surface area of a cube - the lunch options available at school	- Area formulas of polygons such as: rhombus, trapezoid, hexagon etc. - volume and surface area formulas for polyhedrons such as prism, pyramid, cone, frustum, cylinder - the USDA recommendations for teenagers

Actual Student "Knows" and "Need-to-Explore" Lists

KNOWS	NEED- TO - EXPLORE
- Area formulas for basic geometric figures: square, rectangle, triangle, circle	- Area formulas of a rhombus, trapezoid, hexagon, parallelogram, - volume and surface area formula of a cube, rectangular prism, pyramid, cylinder, sphere, cone;

Embedded Learning Activities	
Activity	**"Need to Explore" Question(s) Addressed (informs debriefing questions)**
Students take pictures of the lunches that are typically chosen by students in the cafeteria. They ask students to justify their choices and ask about nutritional value of their meal.	What is served in the WHS cafeteria?
Students conduct research on myplate.gov to learn about the USDA recommendations for teenagers.	How does it relate to USDA recommendations?
Students investigate the district's guidelines for the lunch menu;	How does it relate to USDA recommendations?
Students use formulas for the area, surface area and volume for various geometrical figures to determine the percentage of daily recommended amount of proteins, carbohydrates, fruits, vegetables and dairy.	How do we apply the area, surface area and volume formulas to calculate the percentages of the portions served at WHS?

Anticipated Student Possible Solutions

(What possible solutions might students generate? What materials might you need for them?)

- surveys with answers about typical choices made by students
- healthy options that they can choose from and possible substitutions for unhealthy items
- recommendations for appropriate portion sizes
- students will prepare power-point presentations showcasing their findings
- students will prepare poster-boards with the geometry of the lunch tray
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Actual Possible Solutions Generated

(What different possible solutions did the students generate?)

- students used web-based presentation tools, Prezi, to present their material in a creative and engaging way
- students use the Flip camera to record interviews of the Lunchroom personnel and students
- students investigate the funding for the district and the state government influence on the choices provided to high school students

Anticipated Students' Evaluation of Best-Fit Solution(s)

**[What tool(s) or methods might students use to evaluate/refine their solutions—
e.g., a "Decision Matrix" or a S.W.O.T. Analysis, or a vote based on established criteria?]**

- Students survey those eating lunch in the high school cafeteria about their perceptions of the lunch served at school.
- students try to get feedback from administration regarding lunch
- students attempt to raise awareness among their peers about healthy diets

Actual Student Evaluation of Best-Fit Solution(s)

[What tool(s) or methods did they use to evaluate/refine the solutions? Attach/insert artifact.}

- students prepared presentations to the Freshmen Biology students to educate them about the contents of the lunch served at WHS and how it compares to the recommendations made by USDA on the myplate website.

Resources

Materials--Supplies/Equipment:
Camera, flip camera, rulers, calculators, poster boards, Power Point, Prezi

Thinking/Collaboration/Formative Assessment Routines:

Know- Need to Know sheets to organize student thinking

References—websites/periodicals/books:

Myplate.gov
District 214 Lunch Guidelines on www.d214.org

Places:

Wheeling High School

Additional People:
None

PBL Coach Reflections on the Experience

(What did you learn about yourself? About your students? What surprised you? What were the successes? The challenges? How might you change the design/implementation? What are your take home messages?)

As I was planning the implementation of the PBL Unit in my Honors Geometry classes I was anticipating the results as well as the process. I was somewhat unsure what to expect, how much to plan for and how to motivate students to take ownership in the project. As the PBL experience unfolded I was very excited to see students involved, on task and invested in the research they were conducting. I have learned that I can be flexible in the classroom as issues arise, from technology to deadline expectations during the unit, as well as creative in helping students search for answers needed to complete their project.

I was hoping to complete the project in two weeks. In reality the whole PBL experience, along with some direct geometry instruction took two and a half weeks. Students were very excited about the topic and the fact that it focused on the lunch being served at our cafeteria. They were measuring the dimensions of the lunch tray, calculating the surface area and volume and comparing it to the USDA recommendations. I was impressed with the dedication to detail and accuracy of the calculations and curiosity about shapes that are not usually part of our curriculum.

At the end of the project students presented their data to the Freshmen biology students. Their enthusiasm for the project and research was clearly demonstrated in their presentations. One change that I would consider making next time would be to select three or four presentation to be made rather than all eleven that took place. It would simplify the logistics of presenting to a large group of students.

I am definitely excited to implement another PBL experience in my classes next year. I definitely witnessed increased student involvement and their ability to think outside the box when working on the project. It was great for me to witness not only the Geometry applications but also student's abilities such as public speaking, technology applications and resourcefulness, which otherwise go unnoticed in the traditional teaching.

Geometry of Portion Size – Group Project Rubric

Criteria	4	3	2	1
Organization/ Creativity	Topics flow in an organized manner. Clearly defined sections. Interesting, engaging and aesthetically appealing.	Topics are somewhat organized and are difficult to follow. Some use of color, diagrams. Will engage the audience but will not stimulate.	Topics are not organized and are difficult to follow. Obvious refinement necessary. Very little use of color or pictures but enough to engage and hold attention	No definitive sections. Presentation is scattered and does not follow in logical order. No use of color or diagrams. Interest and motivation not present.
Nutrition Content	All content throughout the presentation accurate, comprehensive and based on credible sources. Includes bibliography. Effective use of MyPlate.gov	Some content is not supported by credible sources. Bibliography is not complete. Use of MyPlate.gov website evident	Content is stated without sufficient support form credible sources. Bibliography is limited. Use of MyPlate.gov is not evident in the presentation.	Content included is made on unsupported statements. Bibliography is not included. Use of MyPlate.gov is not evident in the presentation.
Geometry Content	At least two (or more) geometry formulas presented in the presentation with specific applications. The formula is explicitly taught to the audience during the presentation.	Only one geometry formula presented with application. The formula is taught to the audience during the presentation.	Geometry formula(s) is presented but is not supported by a specific application. Geometry formula is not taught during the oral presentation.	Geometry formulas are not incorporated in the presentation in an effective way. Geometry formula is omitted in the oral presentation.
WHS Relevance	Data presented is relevant to WHS student. Images used are from the lunches served in WHS cafeteria.	Data presented is somewhat relevant to WHS student. Some images used are not from the WHS cafeteria.	Data presented is broad and not specific to WHS lunch. Most images are not representative of a typical WHS lunch	Data presented has no connection to WHS lunch served in the cafeteria. No images represent the WHS lunches.
Presentation/ Group Work/ Recommendations for Biology	All groups members equally contribute to the project as evident on the	Most group members contribute to the project as evident on the	Some group members contribute to the project but are not motivated to	Some group members do not contribute to the project. Some group

Students	presentation/poster. All group members contribute to the oral presentation. Recommendations are explicit.	presentation/poster. Most group members contribute to the oral presentation. Some recommendations included.	do their best work. Some group members do not contribute to the oral presentation. Limited recommendations.	members do not contribute to the oral presentation. No recommendations included.