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# Teacher Quest Tampa Bay Program Action Plan

Jaimi Schulz

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Lesson Title: Build-a-Bridge

Grade Level: 7

Subject Area: Math

Date: 7/9/2010

### **Summer Work Experience**

*Company:* Alliant Techsystems (ATK)

While working at ATK, I learned there are many more steps in building a product than most of us would assume. Engineers must follow a well thought-out process even before they begin to build a product.

I assisted the employees at ATK expedite the parts they have ordered in order to build their products. My responsibilities included speaking with many vendors, tracking down orders, and working with vendors to receive essential parts as quick as possible. I was also given the important task of sending out purchase orders in which the buyers provided.

I was able to re-learn Microsoft Excel, which will enable me to bring these skills back into my classroom. I now have a better appreciation for all the work that goes into the products we buy on a daily basis. I was able to get a good understanding of the behind-the-scenes process and was fortunate to meet so many amazing people along the way.

### **Lesson Plan**

*Objectives:*

- 1) Student will solve real-world problems using data collection.
- 2) Students will learn about engineering design.
- 3) Students will create an Excel spreadsheet.
- 4) Students will understand the importance of team work and problem-solving.

*Sunshine State Standards:*

MA.7.A.1.2: Solve percent problems, including problems involving discounts, simple interest, taxes, tips, and percent of increase or decrease.

MA.7.A.3.2: Add, subtract, multiply, and divide integers, fractions, and terminating decimals, and perform exponential operations with rational bases and whole number exponents including solving problems in everyday contexts.

MA.8.A.1.3: Use tables, graphs, and models to represent, analyze, and solve real-world problems related to systems of linear equations.

*Materials:*

Popsicle sticks, toothpicks, glue gun, hot glue sticks for glue gun, Elmer's glue, regular glue sticks, rope, pictures of types of bridges, paper and pencil, Microsoft Excel, evaluation worksheet, assignment relating to grade level.

*Instructional Procedures:*

This will be a week-long project but may be revised to accommodate time restraints. It incorporates all three learning styles in order to fit the needs of all students.

- 1) Discussion will be held regarding prior knowledge involving multiplication, division, percent, discounts, and sales tax. The importance of teamwork and problem solving should also be introduced here.
- 2) PowerPoint of lesson will be presented to students. This will outline the whole project, step by step and day by day (**See Appendix 1 for PP Presentation**).

Project TTAC

Day 1 (Distribute a copy of the PowerPoint presentation to each team).

In a pair or group (depending on the number of students) the students will work together to choose who receives which job, which will be presented in the PowerPoint introduction. They include program managers, buyers, and engineers. Students will brainstorm and begin to design their bridges on paper. This is a good time to give the students websites where they can look at different types of bridges to get ideas on how to begin designing their bridges on paper.

Websites:

[www.Excelbridge.com](http://www.Excelbridge.com)

[www.brantacan.co.uk/bridges.htm](http://www.brantacan.co.uk/bridges.htm)

[www.abcdpittsburgh.org/kids/kids.htm](http://www.abcdpittsburgh.org/kids/kids.htm)

## Day 2

Money will be given to each team and the buyer, with the assistance of his team, will then fill out the purchase order based on what items the team feels necessary to create their bridge. This purchase order will be given to the vendor (teacher) and materials will be given to each company. No money is exchanged at this time. An invoice will be created by the vendor and given to each company tomorrow. They may begin building (**See Appendix 2 for Purchase Order Form**).

## Day 3

Students should use this time to build their bridge. Students will receive their invoice from the vendor and the buyer will then pay the vendor what is owed for materials. (To add a little excitement: make a mistake on an invoice or invoices and see how the students handle it, or even notice. This may lead to discussion on how to handle problem issues in a professional environment) (**See Appendix 3 for Invoice**).

## Day 4

Students should finish their bridges today.

## Day 5

- Evaluation worksheet – Give students a few minutes to reflect on how they felt their project went. Have them complete the evaluation and turn it in for part of the evaluation process (**See Appendix 4 for Teamwork Evaluation Sheet**).
- The step-by-step directions on how to create an Excel spreadsheet should be presented to students so they can begin creating their spreadsheet (**See Appendix 5 for Excel Tutorial**).

\*\*\*\*\*An assignment with examples of questions for grades 7 and 8 has been attached, which gives ideas on how this assignment relates to Sunshine State standards. This may be used as an introduction to specific chapters in the Pinellas County Math books. (Suggestion: Have students use Excel spreadsheet they have created to answer some questions) (**See Appendix 6 for Sample Math Questions**).

### *Integration of summer work experience:*

The process of supply chain can easily be incorporated into the classroom. I compared the two using four phases. The prep phase is when material should be learned and students become familiar with the concepts before the construction phase begins. Here is when they produce their own product. After the construction phase comes the testing phase. Students must check their work to see if it is ready to be turned in and graded. The final stage is the evaluation stage. This

is when they reflect on how they feel the process went. I have also discussed fieldtrips with my supervisor and he is also willing to be a guest speaker to further the students' understanding of supply chain management.

*Assessment Instruments:*

- 1) Final product.
- 2) Evaluation worksheet, which reflects how they feel they worked in teams, etc.
- 3) Excel spreadsheet-will be able to observe how well they are following directions.
- 4) Final assignment created by using questions about their Excel spreadsheets in which they have created.

# Appendix 1

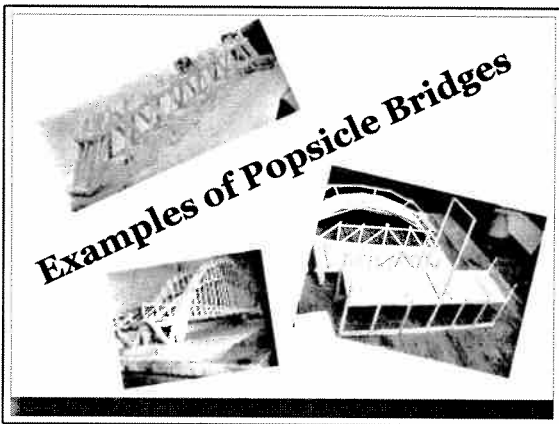
# TTAC PROJECT

OH NO!!





The city of Clearwater made a mistake constructing their bridge...AGAIN.

## THEY NEED YOUR HELP!

Welcome to Project... "Third Time's A Charm"  
(TTAC)



### Things to consider...

-  What materials you will need
-  How much the bridge will cost
-  How much weight the bridge can hold
-  How much time to spend on each part

### Materials

When designing your bridge:

- What is the cheapest but best material?
- Which materials will create the safest bridge?
- How many of each will you need?



### \$\$\$\$\$ MONEY \$\$\$\$\$

You have \$40 to purchase materials to build your bridge.

Cost of materials are as follows:

Part	Cost per unit
Popsicle Stick	\$0.15
Toothpick	\$0.10
Glue Gun	\$2.00
Hot glue stick (for glue gun)	\$0.25
Elmer's Glue	\$1.00
Regular Glue Stick	\$0.50
Rope	\$1.00 (per foot)

### Purchase Order

**YOUR PURCHASE ORDER WILL TRACK HOW MANY OF EACH ITEM YOU HAVE PURCHASED BUT YOU ALSO MUST TRACK HOW MANY OF EACH ITEM YOU ACTUALLY USED.**

### Invoice

## STRENGTH

How do you design your bridge to hold as much weight as possible?

## Time

You will have five days to complete your project.

**Recommended schedule**

Monday	Tuesday	Wednesday	Thursday	Friday
With your team, look at suggested Websites, design your bridge on paper, and choose the materials you need in order to build the bridge.	Fill out your Purchase Order and receive materials. Begin building.	Continue to build. Receive billing invoice and submit payment for materials. (Make sure invoice is correct).	Complete bridge construction today.	Complete Excel spreadsheet and Evaluation.

## Responsibilities

**Project Manager**—will supervise and make sure that the appropriate materials are supplied and that the team is on schedule.

**Buyer**—will complete the purchase order with the help of the team and purchase the material from the vendor...who is me ☺

**Engineers**—will construct the bridge with the assistance of the project manager and the buyer.

# Move it! Time is money!

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# Appendix 2

**YOUR COMPANY NAME**  
 YOUR COMPANY SLOGAN

# PURCHASE ORDER

[Street Address]  
 [City, ST ZIP Code]  
 Phone [(212)444-0123] Fax [(212)444-0144]

**TO:**  
 Schulz Techsystems  
 5642 Schoolisfun St.  
 St. Pete, FL 32304  
 1-800-LUV-MATH

**SHIP TO:**  
 YOUR COMPANY NAME  
 [Street Address]  
 [City, ST ZIP Code]  
 [Phone]

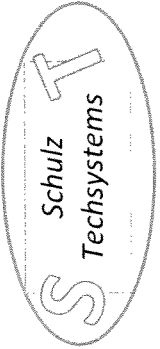
<b>P.O. DATE</b>

QTY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
			SUBTOTAL	
			SALES TAX	
			TOTAL	

1. Please send two copies of your invoice.
2. Enter this order in accordance with the prices, terms, delivery method, and specifications listed above.
3. Please notify us immediately if you are unable to ship as specified.

Authorized by \_\_\_\_\_ Date \_\_\_\_\_

# Appendix 3



Schulz Techsystems  
5642 Schoolisfun St.  
St. Pete, FL 32304

**ORIGINAL INVOICE**  
TERMS NET 30 DAYS

CUSTOMER ORDER NUMBER		REGISTER NUMBER	ACCOUNTING CODE	ACCOUNTING CODE
S H I P T O		B I L L T O		
Project Number	ITEM NUMBER	DESCRIPTION	UNIT PRICE	QUANTITY SHIPPED
				AMOUNT
SUB-TOTAL				
SALES TAX				
TRANS OR POSTAGE				
PAY THIS AMOUNT				
DATE DUE				

SUBMIT PAYMENT TO:

# Appendix 4

Name \_\_\_\_\_

Date \_\_\_\_\_

Company Name \_\_\_\_\_

## Evaluation – Teamwork

Directions: Rate how you feel your team worked together throughout this project.

	Poor	Fair	Average	Good	Excellent
<b>Communication</b>	1	2	3	4	5
<b>Participation</b>	1	2	3	4	5
<b>Organization</b>	1	2	3	4	5
<b>Preparation</b>	1	2	3	4	5
<b>Commitment</b>	1	2	3	4	5
<b>Progress</b>	1	2	3	4	5

Directions: Answer the following questions based on your team's performance.

1. What were our team strengths?
2. What were our team weaknesses?
3. How can we improve our teamwork for the next project?
4. Do you think you would have been able to complete this project easier if you were working alone?



# Appendix 5

## Excel Spreadsheet Tutorial



on your desktop.

1. Double click on the Microsoft Office Excel icon
2. Type the following in the correct boxes (Visual available on next page).

B1	Cost Per Unit
C1	# of Items Purchased
D1	# of Items Used
E1	Money spent
F1	Actual \$ Used
G1	Amount overspent

A2	Popsicle Sticks
A3	Toothpicks
A4	Glue Gun
A5	Glue Sticks (for glue gun)
A6	Elmer's Glue
A7	Regular Glue
A8	Rope

B2	.15
B3	.10
B4	2
B5	.25
B6	1
B7	.50
B8	1

Your Excel spreadsheet should now look like this:

	A	B	C	D	E	F	G
		Cost Per Unit	# of Items Purchased	# of Items Used	Money Spent	Actual \$ Used	Amount Over/Spent
1							
2	PopSicle sticks	0.15					
3	Toolsicks	0.1					
4	Glue gun	2					
5	Glue sticks for glue gun	0.25					
6	Elmer's glue	1					
7	Regular Glue	0.5					
8	Rope	1					
9							
10							

3. With your mouse, click on B2, hold down the button and drag it down to B8 so the whole column is highlighted.

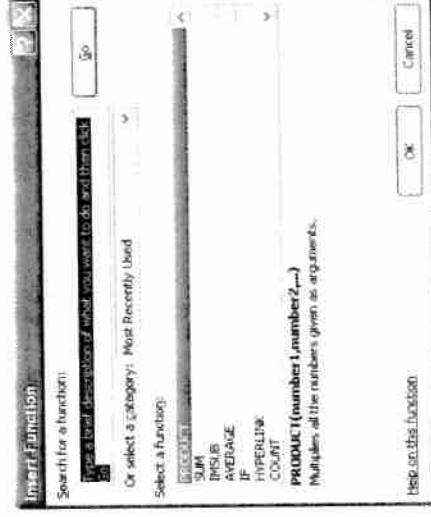
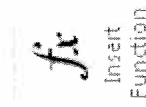
	A	B	Cost Per Unit	# of
1				
2	PopSicle sticks		0.15	
3	Toolsicks		0.1	
4	Glue gun		2	
5	Glue sticks for glue gun		0.25	
6	Elmer's glue		1	
7	Regular Glue		0.5	
8	Rope		1	
9				
10				
11				
12				

4. Go to the box that says General and click on the arrow for the drop down menu. Click on Currency. Your spreadsheet should have turned your numbers into dollar amounts. It should look like this:

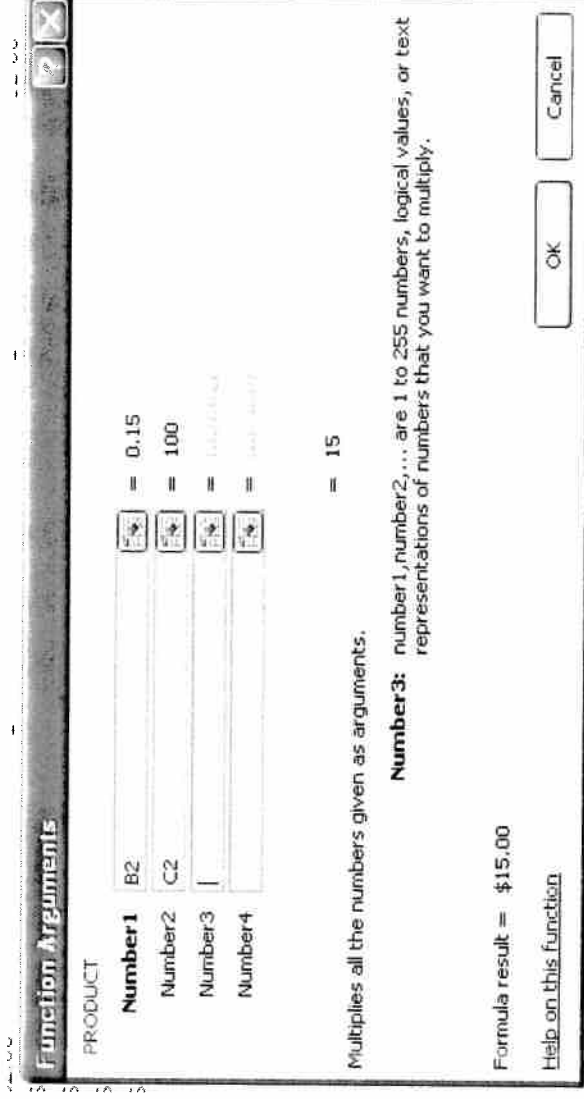
	A	B
1		
2	Popsicle sticks	\$0.15
3	Toothpicks	\$0.10
4	Glue gun	\$2.00
5	Glue sticks for glue gun	\$0.25
6	Elmer's glue	\$1.00
7	Regular Glue	\$0.50
8	Rope	\$1.00
9		
10		
11		
12		

**AT THIS TIME, YOU WILL ENTER YOUR OWN DATA INTO YOUR SPREADSHEET. IN COLUMN C, YOU WILL ENTER HOW MANY OF EACH ITEM YOU PURCHASED. IN COLUMN D, YOU WILL ENTER HOW MANY OF EACH ITEM YOU ACTUALLY USED.**

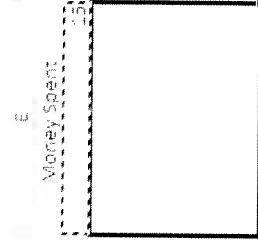
5. Click on E2. Click on the Formulas tab at the top of the page. Then click on Insert Function button to the far left of the screen.
6. Click on PRODUCT and hit OK.



7. In the line that says **Number 1**, type in B2 and in **Number 2**, type in C2 and then hit OK. (This means you are finding the product of the cost of the item and the amount of that item purchased).



8. Right click on E2 and click Copy. There should be a moving dashed line going around E2. Then click on E3, hold down the button and highlight through E8.



9. Right click and click paste. (This will paste the formula into all of those cells).

10. Click on the Home tab at the top left corner of the page. Highlight E2 through E8. Go up to the box that says General. Click Currency.
11. Click on F2. Click on the Formulas tab at the top of the page. Click on insert function to the far left.
12. Click Product and click OK.
13. Where it says **Number 1**, type in B2 and where it says Number2, type D2 and hit OK.  
Right click on F2 and click copy.
14. Click on F3 and hold it down to highlight through F8. Right click and hit paste.
15. Click on the Home tab at the top left corner of the page. Highlight F2 through F8. Go up to the box that says General. Click currency.

**Note: Column E shows how much you spent and Column F shows how much you actually used. In Column G, you will now find out how much you overspent.**

16. Click on G2 and then click on the Formulas tab at the top of the page. Click on insert function to the far left.
17. Click on IMSUB. Where it says **Inumber1**. type in E2. Where it says **Inumber2**, type in F2. Click OK.



18. Right click on G2 and hit copy. Click on G3, hold down button and drag down to highlight through G8. Right click and hit paste.
19. Click on the Home tab. Highlight G2 through G8. Go to the box that says General and in the drop-down menu, hit Currency.

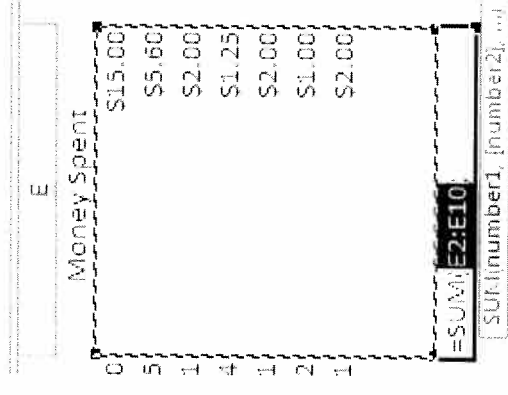
**Note: Column B, E, F, and G should be Currency.**

20. Click on E11. Click on the Formulas tab at the top of the page and click the Insert Function button. (We are now going to add up all of column E to find out how much money you spent on materials).

21. Located next to the Insert Function button, click on the symbol that looks like an E on the Auto Sum button. (If you bring up the scroll-down menu, simply click on Sum).



22. Column E should look like this:



23. Click Enter on your keyboard and you should see the sum of all of Column E in E11.

24. Right click on E11 and click Copy. Click on F11 and right click and choose Paste. This will carry over the same formula and add up all of Column F, which is how much money you actually needed to spend based on materials used.

25. Click on G11. Click on Insert Function. Click on IMSUB. Hit OK.

26. In Inumber1, type in E11 and in Inumber2, type in F11. Hit OK.

**Note: G11 is showing how much money you overspent on materials.**

**YOU HAVE FINISHED YOUR EXCEL SPREADSHEET!  
AWESOME JOB!!**

**There is an example on the next page of what your spreadsheet should look like.**

	A	B	C	D	E	F	G
		Cost Per Unit	# of Items Purchased	# of Items Used	Money Spent	Actual \$ Used	Amount Over/Short
1							
2	Popcorn	\$0.15	100	90	\$15.00	\$13.50	\$1.50
3	Tootsies	\$0.10	50	45	\$5.00	\$4.50	\$0.50
4	Glue	\$2.00	1	1	\$2.00	\$2.00	\$0.00
5	Glue sticks for glue gun	\$0.25	3	4	\$0.75	\$1.00	\$0.25
6	Marker glue	\$1.00	2	1	\$1.00	\$1.00	\$0.00
7	Regular Glue	\$0.50	2	2	\$1.00	\$1.00	\$0.00
8	Rope	\$1.00	2	1	\$2.00	\$1.00	\$1.00
9							
10							
11					\$28.75	\$24.00	\$4.75
12							

# Appendix 6

Name \_\_\_\_\_

Date \_\_\_\_\_

Company Name \_\_\_\_\_

## Examples of Math Questions Related to Excel Spreadsheet

### Grade 7

- 1) What percentage of the popsicle sticks purchased did you actually use when building your bridge?

Ex. If they used 91 out of 100 popsicles, they would solve it by:

$$\frac{91}{100} = \frac{100x}{100}$$

$$.91 = x$$

$$.91 = x$$

$$91\% = x$$

- 2) What is your sales tax for ONLY the popsicle sticks?

Ex. If they bought 100 popsicle sticks, they would solve this by:

Their Excel spreadsheet should read that they spent \$15.00 on popsicle sticks.

$$\$15.00 \times 7\% =$$

$$\$15.00 \times .07 = \mathbf{\$1.05}$$

## Grade 8

- 1) Which would be cheaper? 100 toothpicks at \$0.10 a piece or 75 popsicle sticks at \$0.15 a piece. (Have them work with their spreadsheet and plug these numbers in order to find the correct answer using formulas).
  
- 2) If you buy 130 popsicle sticks at \$0.15 a piece and 105 toothpicks at \$0.10 a piece, what is the total amount of money you have spent (including tax)? (If you do not want to include tax, only Step 1 is necessary).

Ex. Step 1:

Popsicle amount + toothpick amount =

$$[130(.15)] + [105(.10)] =$$

$$19.50 + 10.50 = 30.00$$

Step 2:

(Popsicle + toothpick) x (sales tax) = (tax on total purchase)

$$30.00 \quad \times \quad .07 \quad = \quad 2.10$$

Step 3:

(Popsicle + toothpick) + (tax on total purchase) =

$$30.00 \quad + \quad 2.10 \quad = \quad \mathbf{\$32.10}$$