The TMTA Bulletin

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Inside This Issue

President's Message

I would like to begin with a Big Shout Out to MT^2-NW for planning and hosting an outstanding state conference!

Are you ready to "move mountains"? The board just had their bi-annual meeting and we are looking forward to what this year will bring. Plans are in the works for our state meeting. We head east to Sevierville this September. As always, our state conference offers something for all levels. Please check out the website for details. Share a great idea by presenting, or come learn and collaborate with mathematics educators from across the state.

Please make note of the grant/scholarships that we offer. You could further your mathematics education or meet a need in your classroom. While you are on the website, check out the information on the state math contest. This is a great opportunity for our high school students.

NCTM regional is coming back to Nashville in 2019! We will be looking for volunteers as we live up to our name.

TMTA is on Facebook and twitter @tenn_math_teach. Join and follow! Tweet about your successes with students in the classroom. I hope each of you have a wonderful end to the 2018 school year and I look forward to seeing you in Sevierville this fall!

TMTA Annual Conference Information
Math Moves Mountains
Sponsored by:
TMTA and UETCTM

Location:
Walters State Community College
Sevierville Campus
September 29-30, 2018

Speaker Proposals are currently being accepted. To apply to speak, complete your speaker proposal form at https://tmta.wildapricot.org/Conference. If you have questions about the form or submission process, please contact Sunshine Light at slight@k12k.com. If you have general questions about the conference, please contact Chris Knight Chris.Knight@ws.edu or Miriam Nelson Miriam.Nelson@ws.edu.

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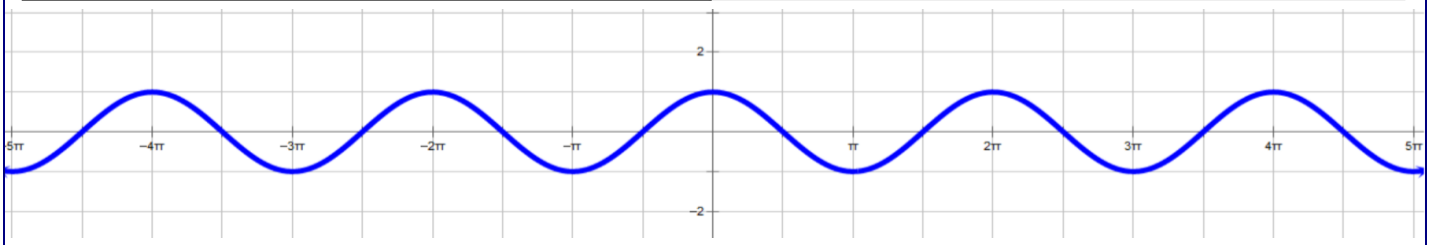


Calendar of Events

Middle School Math Contest	April 12, 2018	
High School Math Contest	April 10, 2018	
NCTM Annual Conference	April 25-28, 2018	Washington, D.C.
NCTM Leader's Conference	July 9-11, 2018	Indianapolis, IN
TMTA Mathematics Conference	Sept 29-30, 2018	Sevierville, TN

Using Regression in Mathematics Courses other than Statistics

Submission by:
Patrick Perdew
Associate Professor of Mathematics
Center for Teaching and Learning
Austin Peay State University

Students in the sciences are typically not required to take statistics courses in the mathematics department. However, with their research, they will encounter it. Typically, the science department in which the student majors offers a statistics course (e.g., biostatistics). This course may not be required, though. To introduce students to statistics, more topics such as regression should be integrated into core mathematics courses.

The core mathematics requirement for a science major is typically Calculus with Analytic Geometry. Students may take a preparatory course such as Pre-calculus. Examining the topics typically covered in calculus shows that regression would be the best topic from statistics to integrate (no pun intended) into the curriculum.

With the coverage of different functions in calculus, regression for each type of function could be covered. Linear and other polynomial regression (quadratic, cubic, quartic, etc.) can be covered when those functions are discussed. Rather than going into in-depth coverage of the derivation of the formulas, or even introducing those, a graphing calculator such as the TI-84 Plus can be used to find the regression equation. This also enables the introduction of real-world examples that use gathered data to produce a function from the regression analysis. This will mirror students' later research. An experiment does not often begin with a known function for the situation, like textbook examples often give for an application. Once the function is produced from the regression, different types of mathematical analysis can be performed on the function as appropriate.

Besides polynomial regression, other types may also be introduced. Power regression is useful for cases with non-integer exponents, which may occur when modeling data from biology (Rockswold, 2014). In addition, logarithmic and exponential regression can be utilized when those functions are examined. Logistic regression can also be used for modeling population growth (Rockswold, 2014), though logistic functions are not usually discussed in calculus. These types of functions can also be used for life science applications. Therefore, the regression for each of these cases can be useful.

Another general topic useful in statistics that should be introduced beforehand is the use of a scatterplot. Once that is made for the data, a student will be able to determine, based on its shape, which regression seems appropriate based on the type of function that appears to best fit the data. The use of interpolation and extrapolation can also be discussed once a function is generated from the regression. The caveats of using extrapolation should also be stressed.

Generally, rather than having students wait until taking a major-specific statistics course, calculus is well suited for the use of regression. Another reason for using regression in calculus is that linear regression is typically the only type of regression covered in an elementary statistics or major-specific statistics course like biostatistics. This is a severe and unnecessary restriction upon the myriad types of functions that can be modeled through regression. Discarding all examples and applications simply because the model is not linear is a restriction that is unnecessary. With a graphing calculator, the same amount of work is required to enter the data, perform a scatterplot, and the select the appropriate regression, regardless of which type of regression is performed. Because a mathematics course is the only one which covers all the types of functions which can be modeled, it is much more appropriate for introducing regression than a major-specific statistics course, like biostatistics.

Mathematics departments should select textbooks which contain application examples using all types of regression in Calculus with Analytic Geometry or any functions-based course. This makes it more convenient for professors so they do not have to search for examples on their own. It is also more convenient for students and more economical for the department when extra handouts need not be produced.

References

[1] G. K. Rockswold, College Algebra with modeling and visualization, 5th ed., Pearson, Boston, 2014.

TMTA Scholarship Opportunities

Dr. Henry Frandsen Scholarship for Teachers

Criteria:

- Applicants must be committed to teaching mathematics in Tennessee at either the secondary or elementary level.
- Applicants must have declared an appropriate major at their institution
- Deadline May 1st

Past Winners:

1. 2011: Amber Atkins (MTSU) and Emily McDonald (Tenn. Tech)
2. 2012: Melinda Pierce (UT Knoxville) and Brandy Smith (Austin Peay State University)
3. 2013: Taylor Satterfield
4. 2014: Leanna Ruth Murdoch
5. 2015: Elizabeth Barlow (UT Knoxville)
6. 2016: Courtney Wright (MTSU) and Hillary Grant (UT Knoxville)
7. 2018: Now taking applications at **https://tmta.wildapricot.org/page-18062**

TMTA Grant Opportunities

$1000 classroom Mini-grant

Criteria:

- Applicant's school or district must demonstrate financial need;
- Applicant must attend the TMTA Fall Conference to receive your award; and
- Applicant must speak at the next TMTA Fall Conference about your use of the mini-grant.
- Application deadline is May 1.

Past Winners:

- 2013: Tammi Terry
- 2014: Lea Keith
- 2015: Emily McDonald
- 2016: Deana Secrest
- 2017: Teresa Agee
- 2018: Now taking applications at **https://tmta.wildapricot.org/Grant**

TMTA Teacher/Scholar Award

Are you pursuing an advanced degree to improve your mathematics teaching? There are scholarship funds available to support your learning!

The TMTA Teacher/Scholar Award is awarded to a TMTA member currently teaching in Tennessee and pursuing either a Masters, Ed.S., or doctoral degree to improve his or her mathematics teaching.

The award includes a $1000 Scholarship and free TMTA membership for a year.

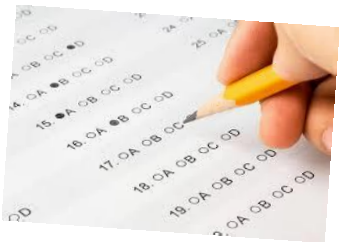
All you need to do is click on this link: Scholarship Application Form (PDF File) and follow the directions on the application. The deadline for the application is May 1. Don't delay!

We want to support you in your pursuit of teaching excellence!

Test Writers Needed!

High school math test writers are needed! Each of the six exams (Algebra I, Algebra II, Geometry, Precalculus, Calculus and Advanced Topics, Statistics) is a 40 question multiple choice test, with each question having five possible responses. Writers should include additional questions for consideration. TMTA will pay a single stipend of $500 to the author once the test has been submitted, reviewed, corrected if necessary, and accepted for use. Qualified applicants should work in a post secondary setting and have at least a year of experience. A test writer guideline is available for interested applicants.

If you are interested, please e-mail the Examinations Director, David Ray.



Examinations Director
David Ray
Department of Mathematics and Statistics
E-mail: davidray@utm.edu

If you would like copies of some previous tests, these are available on the TMTA website: https://tmta.wildapricot.org/Contests.

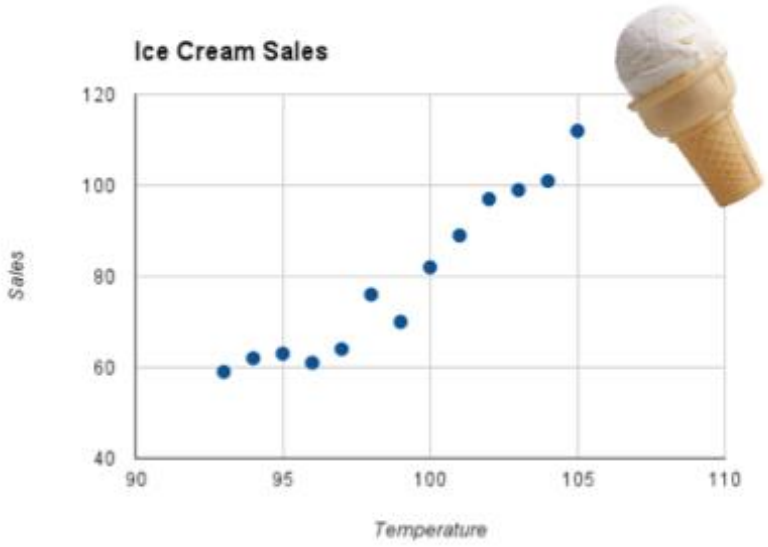
My Favorite Lessons

Grizzly Bear Scatterplots
Rachel Wheaton, 8th grade math and Algebra 1
Northeast Middle School

This is a STEM lesson that incorporates 8th grade science standards:
GLE 0807.5.3 Analyze how structural, behavioral, and physiological adaptations within a population enable it to survive in a given environment.
0807.5.3 Compare and contrast the ability of an organism to survive under different environmental conditions.
SPI 0807.5.3 Analyze data on levels of variation within a population to make predictions about survival under particular environmental conditions.
GLE 0807.5.4 Explain why variation within a population can enhance the chances for group survival.
GLE 0807.5.5 Describe the importance of maintaining the earth's biodiversity.
0807.5.4 Collect and analyze data relating to variation within a population of organisms.
SPI 0807.5.3 Analyze data on levels of variation within a population to make predictions about survival under particular environmental conditions.
SPI 0807.5.4 Identify several reasons for the importance of maintaining the earth's biodiversity.

This lesson is taught towards the end of the unit on bivariate data analysis.

Daily Target	Standard: 8.SP.A.1, 8.SP.A.2, 8.SP.A.3 Clear Target: Students will create a scatter plot using data and use the scatter plot to draw conclusions.
Assessment of Daily Target	CFU: What are the variables? Which one goes on the x-axis? Y-axis? How do you know where to draw a line of best fit? How can you make a prediction for a point that is not on your plot? How can you use your scatter plot to determine if grizzly bears should be delisted? What other data might we need to consider?
Materials Needed	Youtube video, STEM rubric, STEM Grizzly data, link to article, graph paper

Instructional Strategies	**Warm up**: Draw a line of best fit and write an equation for the line. What can you learn from the data? Make a prediction for sales when the temperature is 90 degrees.  **Hook**: Show students this short video on grizzly bears: https://www.youtube.com/watch?v=TSSPDwAQLXs Students should write down at least 3 facts that they find interesting or did not know about grizzly bears. I will explain that grizzly bears were put on the endangered species list. I then have students share what they know about what that means. Then explain that, if a species rebounds, it can be taken off the endangered species list, or "delisted." Delisting only happens if a species demonstrates population growth and it is determined that the species can now survive on its own with existing state regulations. The students' job is to determine if grizzly bears should be delisted by creating and analyzing a scatter plot of grizzly population in Yellowstone National Park. **Independent Practice**: [ASSESSMENT GRADE] Use your grizzly bear data to create a scatter plot showing the population of grizzly bears over time. Predict the current (2018) grizzly bear population. **Closure**: Complete the following steps and write a paragraph response: 1. Compare your scatter plot to one of your classmates'. What similarities do you observe? What are the differences? What could account for the differences? 2. Using your data, determine if grizzly bears should be delisted. Cite specific evidence and reasons. **Homework**: Finish paragraph analysis **Next Day**: Have students share their reasoning and conclusions about delisting grizzly bears. Have them read this article explaining that, in June of 2017, grizzly bears were delisted. https://www.npr.org/sections/thetwo-way/2017/06/22/533965856/after-42-years-yellowstone-grizzly-will-be-taken-off-endangered-species-list If time allows, then show this 9 minute video on grizzlies in Yellowstone: https://www.youtube.com/watch?v=S98tneF-VaM
Differentiation	**Struggling Students**: During guided practice teacher will provide one on one guidance. **Advanced Students**: Students will help walk struggling students through the steps. Student will also be asked to brainstorm and research other problems that scatter plots may help to solve.

Data for lesson and scoring rubric

Yellowstone Grizzly Bear Populations

Year	Population Estimate
1995	175
1996	223
1997	266
1998	339
1999	343
2000	354
2001	361
2002	416
2003	416
2004	431
2005	361
2006	405
2007	571
2008	596
2009	582
2010	602
2011	593
2012	610
2013	600
2014	757

Graphing : STEM - Grizzly Bears

Student Name: _____

CATEGORY	3	2	1	0
Title	Title clearly relates to the problem being graphed (includes both variables). It is printed at the top of the graph.	Title clearly relates to the problem being graphed and is printed at the top of the graph.	A title is present at the top of the graph.	A title is not present.
Labeling of Axes	The axes have clear, neat labels that describe the units used for both variables.	The axes have clear labels that describe the units used for one variable.	At least one axis has a label.	The axes are not labeled.
Units	All units are described with labels and are appropriately sized for the data set.	Most units are described with labels and are appropriately sized for the data set.	All units are described with labels but are not appropriately sized for the data set.	Units are neither described NOR appropriately sized for the data set.
Accuracy of Plot	All points are plotted correctly and are easy to see. A straight edge is used to draw a line of best fit.	All points are plotted correctly and are easy to see. A line of best fit is included.	Most points are plotted correctly.	Points are not plotted correctly OR extra points were included.
Prediction for 2018	The predicted plot for 2018 is indicated on the graph. The prediction makes sense given the data and line of best fit. The population prediction is stated in a complete sentence.	The predicted plot for 2018 is indicated on the graph. The prediction makes sense given the data and line of best fit.	The predicted plot for 2018 is indicated on the graph.	No prediction for 2018 is indicated on the graph.
Paragraph		Paragraph response is on back of paper. Response addresses all questions, is thoughtful, and written in complete sentences.	Paragraph response is on back of paper. Response addresses some questions, is thoughtful, and written in complete sentences.	Paragraph response is not included or is not in complete sentences or does not address the questions asked.

Drop by Drop
Pre-k through 2nd
NCTM Illuminations
https://illuminations.nctm.org/Lesson.aspx?id=711

In this lesson, students recognize and use the attributes of volume. They engage in activities that promote understanding of how to measure volume using standard units.

Gather students so they can see the book and hear the story, *Drip, Drop*, by Sarah Weeks. This story portrays a mouse that keeps getting leaks in his roof during a rainstorm and chooses to catch the water with different kitchen containers (i.e. a pan or cup). After reading the story, explain that each pair of students will pretend that it has rained in the classroom and will measure how many cups and tablespoons different containers can hold using the "rain" that fell.

Prepare approximately one quart of water for each pair of students. Also give each group of students three or four different containers with which to measure the volume. None of those containers should hold more than one quart of water. For demonstration purposes, use a quart of water, a couple of empty containers, and a cup for measuring.

Model for the students how to measure the number of cups of water a container can hold by moving one cup from the full container to the empty container. Explain that you are measuring the volume of the different containers. Have the group count aloud each cup of water you move from the quart you have prepared to the empty containers. When the containers are full, discuss that the volume of the container was __ cups. Repeat the demonstration using different containers or different measuring devices and units. Use non-standard measures for younger students and with those students who need additional experiences with nonstandard units.

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Tweet us!

@tenn_math_teach

Please note all images came from the TMTA website, NCTM Illuminations, or from creative commons.
If you would like to share information, lesson plan ideas, or tips for instruction, please email Lisa Elliott at Lisa.Elliott@cmcss.net.
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