Dimensions in Mathematics

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Dimensions in Mathematics
Journal of the Florida Council of Teachers of Mathematics

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From the President's Desk . . .

Dear FCTM Members,

It's been a wonderful start to 2016! Our organization has been working hard in moving towards accomplishing the goals we set aside for the next few years. As a reminder, we developed five priorities that will help guide us as we continue to make FCTM a forward thinking organization aimed at supporting mathematics education in Florida. They are:

1. Revamp our website and brand to be more user friendly and appropriate for today's mathematics educators in Florida.

2. Continue to support our current affiliate groups and work to increase the number of mathematics education leaders across Florida.

3. Re-establish our role as a leader in providing input on mathematics education policy to the Florida Department of Education and the State Board of Education.

4. Work with The National Council of Teachers of Mathematics (NCTM) in planning the 2017 NCTM Regional Conference that will be held October 18 – 20, 2017 in Orlando, Florida.

5. Update and share the Florida Standards Presentations that were developed by the FCTM Board of Directors and consider development of additional modules.

You may have already noticed some changes to our website. We hope you find it easier to navigate and less cluttered. We have also made progress in the development of a completely new website and are expecting to have a new web design within the next year! We want to give a special thanks to Jeffrey Baugus, our webmaster, for his hard work on this project.

Additionally, we have been working closely with NCTM in the beginning stages of planning the 2017 NCTM Regional Conference held in Orlando, Florida. We are excited to let you know that FCTM will have a special "Florida" strand of sessions during this conference. We will be organizing twenty specific sessions aimed at Florida educators. These are not intended to exclusive sessions for the participants attending from around the country; rather they are being developed with the specific needs of Florida educators in mind. More information will be coming very soon!

As a reminder, please consider applying for the numerous grants and awards that FCTM offers to its members. The deadline for these grants and awards is June 1, 2016, and specific information can be found on our website.

Finally, I hope you'll go ahead and mark your calendars for our 64th Annual FCTM Conference. Our conference committee is planning a one of a kind experience for you October 20 – 22, 2016 at the DoubleTree by Hilton Orlando at Sea World. We are looking forward to joining you there! Follow us on Twitter or like our Facebook page for the most up to date information on this year's conference and all things FCTM!

I am so very grateful for opportunity to lead this incredible organization. If I can be of any service to any of our members, please do not hesitate to reach out.

Zachary Champagne
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Zorin, Barbara, Patricia D. Hunsader and Denisse R. Thompson
Are Mathematical Practices Visible in Your Classroom?
Dimensions in Mathematics
SPRING 2016, 36 (1), p. 5 – 13.

Are Mathematical Practices Visible in Your Classroom?

Barbara Zorin, Patricia D. Hunsader and Denisse R. Thompson

What progress have you made in integrating the mathematical processes from the National Council of Teachers of Mathematics (2000) or the mathematical practices of the Common Core (National Governors' Association and Council of Chief State School Officers, 2010) into your classroom curriculum? Before reading further, reflect on the following typical textbook item and bulleted questions:

> *Baker's Music store has new CDs for $15 each with 30% off. What will be the sales price of 2 CDs, without tax?*

- How similar is the item to ones in your curriculum materials?
- What mathematical processes or standards for mathematical practice do students have an opportunity to demonstrate with this item as written?
- How might the item be modified to provide students with more opportunities to engage with mathematical processes or practices?

We believe items used as part of classroom instruction should reflect what is valued in the learning of mathematics, both in terms of content and essential mathematical processes/practices. Even though Florida dropped out of the Common Core State Standards for Mathematics, the eight standards for mathematical practice [SMP] described in that document relate to the NCTM mathematical processes (Koestler, Felton, Bieda, & Otten 2013), and are at the heart of helping students develop a deep understanding of mathematics. These standards of mathematical practice are a part of the Florida Standards k – 12 and are included in the course descriptions adopted by Florida. Their inclusion as a regular part of classroom instruction is part of helping students develop the flexibility in thinking needed to be proficient with the Mathematics Florida Standards.

You likely viewed the opening item as providing an opportunity for students to engage with precision (SMP 6) as students find the sale price. But could this item be adjusted slightly to provide students opportunities to engage with additional mathematical practices? Often, small changes to existing textbook items can produce big benefits by enabling students to demonstrate mathematical thinking (Hunsader, Thompson, & Zorin 2014).

In this article, we illustrate how items typically found in textbooks or other curriculum materials can be modified to enhance students' potential opportunities to engage with the mathematical practices.

Seven Strategies for Modifying Mathematical Items to Increase the Visibility of the SMP

Table 1 lists seven strategies we discuss and the mathematical practices that might become visible with application of each strategy. We then describe the types of items for which the strategy might be feasible and then share an item similar to ones found in curriculum materials and a possible modification using the strategy. Throughout, we discuss potential mathematical practices with which students might engage for both the original and modified items.

Table 1. Modification Strategies to Make Mathematical Practices Visible

Strategy	**Standards for Mathematical Practice**							
	1	2	3	4	5	6	7	8
Begin at the End	X	X	X			X	X	
Changing Conditions	X	X	X	X		X	X	X
Multiple Pathways	X	X	X	X		X		
Play the Critic	X	X	X			X		X
Tell the Truth		X	X			X	X	
Spotlight on Errors		X	X			X	X	
What's the Story?	X	X		X		X	X	

Note: SMP 1 = make sense of problems and persevere in solving them; SMP 2 = reason abstractly and quantitatively; SMP 3 = construct viable arguments and critique the reasoning of others; SMP 4 = model with mathematics; SMP 5 = use appropriate tools strategically; SMP 6 = attend to precision; SMP 7 = look for and make sense of structure; SMP 8 = look for and express regularity in repeated reasoning (CCSSM 2010).

Begin at the End

For this strategy, the item is modified to start with the answer and challenge students to develop the question (Barlow & Cates 2006; Kaur 2012).

Original Item: The number of minutes athletes took to run a race is shown in the stem-and-leaf plot. What is the mean time to complete the race?

Race Completion Times										
8	0	1	4	5						
7	1	1	1	2	4	5	5			
6	1	1	2	2	3	7	8	8	8	9
5	2	3	3	5	5	5	5	7	8	9
4	3	5	5	6	9					

The original item requires students to interpret the stem-and-leaf plot (SMP 1) and apply the algorithm for finding the mean (SMP 6). However, a teacher may not be able to evaluate much more than if the student obtained the correct answer; the student's solution approach may not be evident and any misunderstandings may not be visible.

Modified Item: The number of minutes athletes took to run a race is shown in the stem-and-leaf plot.

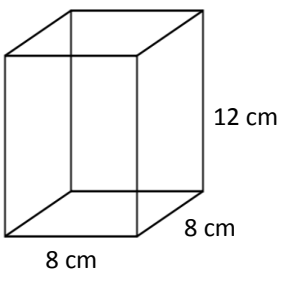
- What is the question if the answer is 62? (median)
- What is the question if the answer is 63? (mean)
- What is the question if the answer is 55? (mode)
- What is the question if the answer is 42? (range)
- What could the number 36 represent to a runner? (number of racers)

In the modified item, students must grapple with various understandings of central tendency. In making sense of the item, students must realize that 36 cannot be any measure of central tendency because no data value is in the 30s. With the modification, students not only make sense of the problem (SMP 1) and attend to precision (SMP 6), but they also make sense of the structure of the stem-and-leaf plot (SMP 7) and reason quantitatively (SMP 2). As they share solutions, students construct arguments (SMP 3).

Changing Conditions

This strategy is useful in problems where it is feasible to change one or more conditions, asking students to compare results (Kaur 2012).

Original Item: Find the volume of this square prism.



What mathematical practices might students use in this item? Clearly, students can apply a volume formula to obtain a numeral answer with appropriate units (SMP 6). Similar to the previous item, a teacher may not be able to evaluate a student's solution method as only a numerical answer is required. A teacher has no way to gain insight into a student's thinking and there is no real opportunity for reasoning that could be useful in the future.

Modified Item: Given the square prism shown:

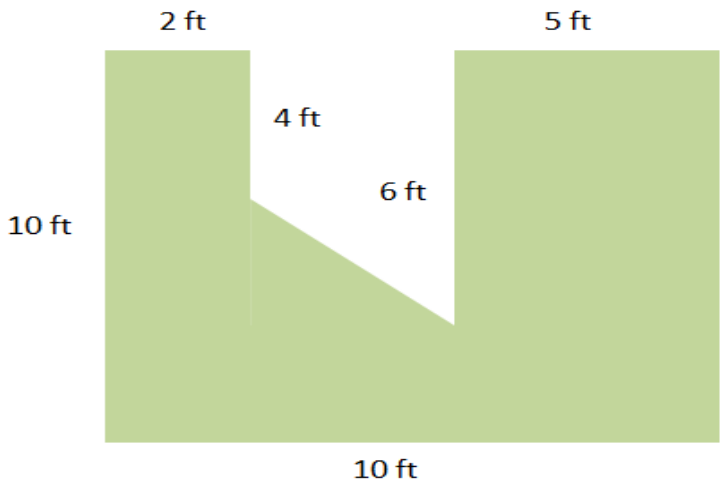
- What are the new dimensions of the base if the height is doubled but the volume stays the same?
- What are the new dimensions of the base if the height is tripled but the volume stays the same?
- What are the new dimensions of the base if the height is cut in half but the volume stays the same?
- What are the new dimensions of the base if the height is divided by 3 but the volume stays the same?
- Generalize the pattern.

In the modified item, a student must make sense of the problem (SMP 1), model the mathematical concept of volume (SMP 4), and then use various parameters to look for patterns (SMP 8). In considering the item's structure (SMP 7), the student might recognize that the area of the base is halved, cut in third, doubled, or tripled in each case, but then reason (SMP 2) to consider how the base dimensions are affected given that the square of the side length determines the base area. In generalizing the pattern, the student expresses regularity in repeated reasoning (SMP 8) and constructs an argument to describe the pattern (SMP 3). The modified item still has students working with volume, but is richer and provides more opportunities for students to demonstrate mathematical thinking than the original.

Multiple Pathways

This strategy works particularly well for items that can be solved in multiple ways. Simply expect students to show or explain more than one way to find a solution.

Original Item: Find the area of the shaded region.



As written, the item potentially engages students in making sense of the problem (SMP 1) and attending to precision (SMP 6). Unless a teacher requires students to show work, the teacher may not even be able to assess if the student understands formulas for area.

Modified Item: Find the area of the shaded region using two different methods. Illustrate one method you used on the diagram and draw arrows to connect your work on the diagram to the parts of your solution.

With the modification, students not only make sense of the problem (SMP 1) but must model with mathematics (SMP 4), reason quantitatively (SMP 2), and construct an argument (SMP 3) as they demonstrate their method. There are various methods that can be used to deconstruct the figure. If students share their work with the class, peers can critique an approach to determine its efficiency and generalizability, providing additional aspects of SMP 3.

Play the Critic

This strategy is applicable when there are two or more possible solution paths. To modify an item using this strategy, illustrate multiple solution paths and ask students to critique those paths.

Original Item: Baker's Music store has new CDs for $15 each with 30% off. If sales tax is 5%, how much will 2 CDs cost on sale?

As written, the student has opportunity to engage with basic mathematical practices often evident in many problems, making sense of the problem (SMP 1) and attending to precision (SMP 6). But with minor tweaking, the item can provide much more.

Modified Item: Baker's Music store has new CDs for $15 each with 30% off. If sales tax is 5%, how much will 2 CDs cost on sale?

> *Jake's solution*: "I multiplied 15 by 2, then multiplied the total by 30% to get the amount off. I subtracted this amount from $30 to get the total of the two CDs. Then I multiplied that amount by 5% to get the amount of tax and added the tax to the cost of the two CDs."
>
> *Suzie's solution*: "I multiplied $30 by 70% to get the sales price, then added the 5% sales tax to that amount."
>
> a. Who is correct? Explain your thinking.
> b. Explain how to use Suzie's method if the sale is 40% off.
> c. Will Suzie's method always work? Explain how you know.
> d. Savorn found the final price as $0.7 \times 1.05 \times \$30$. Does this method always work? Why or why not?

The modified item not only maintains the mathematical practices of the original, but also engages students in critiquing the reasoning of others (SMP 3) and reasoning about the methods suggested by Jake, Suzie, and Savorn (SMP 2), while generalizing about regularity in the approaches (SMP 8). So, again with minor adjustments, the modified item potentially engages students in more of the mathematical practices than the original, while maintaining the mathematical content focus. In addition, students can evaluate efficient approaches (Suzie's or Savorn's) that may be different from their typical approach. Indeed, "requiring students to explain how or why they determine that a proof [or in this case a solution approach] is valid or not provides different insights into their thought processes [than when simply looking at their own solution]" (Thompson and Senk, 1993, p. 170).

Tell the Truth

As teachers gain experience, they discover many concepts for which students struggle with misconceptions. Such concepts can provide opportunities for teachers to pose questions that prompt students to investigate the concept in a way that identifies the misconception. With this strategy, students are asked to determine if something is *always*, *sometimes*, or *never true* and to explain their response (Thompson 2012).

Original Item: Expand: $5(2 - 4x)$.

Students at many levels regularly do not carry the multiplication through all terms in the parentheses when distributing, regardless of how many times their teacher reminds them of the process. So, at issue might be how else to attempt a focus on precision (SMP 6). The modified item provides one approach.

Modified Item: Is the following equation *always*, *sometimes*, or *never* true? How would you convince someone that your answer is correct? $5(2 - 4x) = 10 - 4x$

In the modified item, students still engage with the same content, but now also reason abstractly (SMP 2), critique the reasoning of others (SMP 3), and make sense of structure (SMP 7) as they consider the fact that sometimes the statement is true (if the variable is 0).

Spotlight on Errors

This strategy is a variation on *Tell the Truth*, and is another way to highlight common errors students make. Teachers provide sample student work that contains an error, and ask the students to find, correct, and explain the error.

Original Item: Solve: $4x - 7x < -24$.

As written, the main mathematical practice required of students is attending to precision (SMP 6). Students might engage in reasoning abstractly (SMP 2) or constructing an argument (SMP 3) if they show their steps and explain the property used to transform one step to another. Unfortunately, such explanations are rarely expected so the teacher receives only limited information about students' understanding.

Modified Item: Correct the mistake in the following work and explain the error made.

$$4x - 7x < -24$$
$$-3x < -24$$
$$x < 8$$

As modified, students must critique the reasoning of others (SMP 3), attend to precision (SMP 6), and make use of structure (SMP 7). The modified item informs students an error exists that must be found. A variation would be to ask students *if* an error has been made, and if so, to explain what error was made.

What's the Story?

This final strategy is appropriate when starting with a non-contextualized expression or equation; the item is modified by asking students to create a real-world context that would be solved with that expression/equation (Thompson, Beckmann, & Senk 1997).

Original Item: Solve: $0.35p - 25 > 0$.

As written, the item simply asks students to solve an inequality and provides limited opportunity to engage with mathematical practices (SMP 6).

Modified Item: Write a real-world problem that would be solved with the following inequality: $0.35p - 25 > 0$.

With the modification, students make sense of the problem (SMP 1), reason abstractly (SMP 2), model with mathematics (SMP 4), and make use of structure (SMP 7) in thinking about what types of situations could be expressed with this inequality. Students often solve such skill problems or solve real-world problems developed by the teacher or presented in the curriculum. We believe students with a robust understanding of concepts should also be able to identify appropriate contexts on their own.

Conclusion

Teachers' decisions about the items used in classroom instruction affect their students' involvement in learning mathematics and the extent to which their students' work provides insight into their mathematical understanding that can inform future instruction. Mathematical practices and/or processes are essential to robust mathematical understanding and might be considered the "heart and soul" of mathematical learning. Although we are not suggesting that *every item* needs to engage with multiple practices or processes, we do believe they need to be more visible than in many curricular items available for use in classroom instruction or homework. As shown in this article, incorporating the mathematical practices/processes does not need to be difficult, time consuming, nor involve the use of lengthy or complex items. Rather, it requires that we, as teachers, be sensitive to the potential for students to engage with the practices in the items we use or assign. The use of tools (SMP 5), which we did not address in our strategies, would be integrated as teachers determine which tools, such as calculators, they make available for students to use on given items. The responses we have received from teachers with whom we have shared these strategies have affirmed our belief that item modification has great potential to support implementation of important practices and processes we value in mathematics education. Items in our curriculum can often be easily modified using one or more of the discussed strategies to build a richer learning environment.

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Johnson, Jason
A Florida Teacher Using Word Problems Grounded in Ethnomathematics
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A Florida Teacher Using Word Problems Grounded in Ethnomathematics

Jason Johnson

I am a former Winter Springs High School mathematics teacher (Seminole County Florida). My mentor in undergraduate school was the late Dr. Douglas Brumbaugh, Professor Emeritus in the College of Education and Human Performance at the University of Central Florida, who encouraged all this students to "teach students' for their future and not our past." While in my first years of teaching, Dr. Brumbaugh checked-in from time-to-time; asking, "how is teaching?" and "is it what you expected?" We continued our conversation about teaching students of different cultures. When I started teaching mathematics education courses, Dr. Brumbaugh emailed; asking his two questions - "how is teaching?" and "is it what you expected?" He was someone who led me to the idea of culture in the teaching and learning of mathematics.

As a mathematics educator, the idea of using culture as a way for students to explore mathematics has become my primary research interest. An opportunity was given to me to teach mathematics on the island of Kuda Huraa in the Republic of the Maldives (the Maldives). This article will explore an activity I created and used with students on the island of Kuda Huraa that encouraged students to write word problems grounded in ethnomathematics. The article, then, will provide an example for students and instruction and what teachers can do to promote ethnomathematics.

What is Ethnomathematics?

Ethnomathematics is the relationship between culture and mathematics (D'Ambrosio, 1985). Ethno explains "the cultural identity of a group: language, codes, values, jargon, beliefs, food/dress, habits, and physical traits." Mathematics describes a "broad view of mathematics which includes ciphering, arithmetic, classifying, ordering, inferring, and modeling" (D'Ambrosio, 2001, p. 308). Ethnomathematics seeks to educate students with the skills necessary to function successfully in the world and encourages alternative methods for solving problems. Ethnomathematics also affirms the learner's cultural identity and motivates the learner to consider higher levels of mathematics (Rosa and Orey, 2007).

The Maldives

The Republic of the Maldives is a country that is made of 1190 coral islands and a double chain of 26 atolls, covering 90,000 square kilometers. The capital and the largest city is Malé. The country's religion is Sunni Muslim and the spoken language is Dhivehi. However, many Maldivians speak English. The estimated population of the Maldives is around 379,000 (2008). Tourism and fishing are major industries.

The Activity

I was teaching in the Republic of the Maldives, and I wanted to connect the mathematics to the Maldivian culture, when possible. One activity I created explored multiplication and division. The activity conveyed the social cultural perspective(s) of the Maldivian culture through a lens of the student. The activity also encouraged the students to write and develop word problems that were grounded in ethnomathematics. Such examples were watermelon sales, fishing, dhoani sales, and population. The activity contained two parts:

Part 1: Create a word problem where multiplication is used to calculate the answer. The word problem should relate to the Maldivian culture.

Part 2: Create a word problem where division is used to calculate the answer. The word problem should relate to the Maldivian culture.

The next section will provide a sample multiplication and division word problem written by two different students, benefits for students & instruction and what teachers can do to promote ethnomathematics.

Multiplication

Students in the Maldives were to write a multiplication word problem that was grounded in ethnomathematics. One example was:

> *D. Since 1905 Zihaan is a famous merchant in Thodu who envolves in watermelon business. This week he sells 50 watermelon each day at 5 Rf each*
>
> *Q. What is the total amount of Rf he earns this week?*

For this student word problem, Zihaan is a famous merchant in Thoddoo. Thoddoo is an island in the Maldives that is the largest producer of watermelons. According to the student problem, each watermelon sells for 5 MVR (Maldivian Rufiyaa – Maldivian currency, Rf to the students), which is around 0.33 USD. For this particular week, Zihaan sells fifty watermelons each day; the learner is to calculate the amount of Zihaan's earnings for the week. This is a wonderful word problem that allows a learner to demonstrate his/her ability to use multiplication. The learner would need to understand that fifty watermelons are sold each day of the week and that the price for each watermelon is 5 MVR. A solution for this word problem could be: 50 watermelons × 7 days = 350 watermelons. After the total number of watermelons for the week have been calculated, next the calculation for Zihaan's earnings can be determined by taking the total number of watermelons multiplied by the price for each watermelon: 350 watermelons × 5 MVR = 1,750 MVR.

The student multiplication word problem was grounded in ethnomathematics, because it contained a Maldivian cultural example. In the word problem, a learner should calculate watermelon sales for a famous merchant on the island of Thoddoo. The student was able write to learn mathematics, write a word problem to express mathematics literacy, and use ethnomathematics to contact the word problem to the Maldivian culture.

Division

Next, the students were to write a division word problem that was grounded in ethnomathematics. A sample can be found below:

> *Thoddoo is the most famous and specialize watermelon farming island in Maldives. If for a day they can get 500 watermelons for selling and there are only two customers for them. If they sell them equally among two customers, how much does each customer get ?*

This is another example for the island of Thoddoo. This is not from the same student who wrote the sample multiplication word problem above. The students in the

class who were from Thoddoo, agreed that packaging five hundred watermelons for two transactions, is realistic; typically other islands (in the Maldives) would purchase similar quantities. In the problem, the island of Thoddoo has an order of five hundred watermelons that is to be sold between two customers evenly. The learner must calculate how much each customer is to receive. A sample solution could be: $\frac{500 \text{ watermelons}}{2 \text{ customers}} = 250$ watermelons for each customer.

The student was able to capture the essence of the Maldivian culture in the above division word problem. Similar to the sample multiplication word problem, the student used Thoddoo, an island known for exporting the most watermelons in the country (according to the students). The learner would need to calculate the number of watermelons each customer is to receive. The student was able to write a word problem and use the Maldivian culture to explore mathematics.

Benefits for the Student

Below are benefits for student writing to learn mathematics, student writing word problems to make sense of mathematics, and student engaged in ethnomathematics.

Writing to learn mathematics allows students to:

- Communicate mathematical thinking,
- Take ownership for learning,
- Retain information,
- Increase higher-order cognition skills,
- Decrease anxiety.

Writing word problems allows students to:

- Experience confidence,
- Solve future word problems,
- Increase enthusiasm for learning,
- Become better problem solvers
- Increase motivation to solve word problems

Engaging in ethnomathematics allows students to:

- Accept other cultures,
- Accept student's culture,
- Increase self-esteem
- Excite interest in mathematics
- Pursue higher mathematics

Benefits for Instruction

When students write to make sense of mathematics, student writing and ability to express mathematical ideas are improved. As teachers require their students to write word problems, these word problems can be used from year-to-year (Johnson, 2011). Meaningful word problems instead of routine exercises are beneficial for student success with mathematics (Martinez, 2001; Amit and Klass-Tsirulnikov, 2005). Learning

mathematics using ethnomathematics strategies improves student cultural identity and motivates students to consider higher levels of mathematics.

What Can Teachers do to promote writing, word problems, and ethnomathematics?

Teachers can promote student writing by using journals, writing prompts, developing word problems, and/or writing tasks (Miller, 1992). Teachers can encourage student engagement with developing word problems by allowing students to create word problems in groups, answer other student created word problems, and/or present solutions to the class (Winograd and Higgins, 1994). Teachers can foster ethnomathematics by allowing student to explore mathematics based on the student culture and/or other cultures.

Conclusion

This opportunity was an unforgettable experience. As a Florida teacher, I have learned from many students and colleagues about the teaching and learning of mathematics. It was my aim that this article would inspire teachers to consider word problems grounded in ethnomathematics as a way to reach *all* students.

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Dupree, Lakesia L. and Sarah VanIngen
Plan to Pose Purposeful Questions
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Plan to Pose Purposeful Questions

Lakesia L. Dupree and Sarah VanIngen

An Introduction to Questioning

The National Council of Teachers of Mathematics (NCTM) recent publication, *Principles to Actions: Ensuring Mathematical Success for All* (2014) defines eight key mathematics teaching practices. One of these practices is *Posing Purposeful Questions*. Teachers are encouraged to pose purposeful questions in order to "assess and advance students' reasoning and sense making about important mathematical ideas and relationships" (p. 35).

The importance of questioning in mathematics teaching is not something new. In fact, in the mathematics education literature, there are several well-known frameworks for using questioning in mathematics teaching. For example, Boaler and Brodie (2004) identified nine categories for questions that ranged from the most basic category- "gathering information" to the most complex, "establishing context" (p.777). In their research, Baoler and Brodie found that teachers mostly posed questions from the most basic category. These are lower level questions that require students to recall or restate information. Their findings also suggested that greater variety of questions lead to more enriching classroom discussions and fostered an environment that challenged students to think more critically about their answers. In classrooms where teachers varied the types of questions that they asked their students, Boaler and Brodie found that students were more likely to question themselves as well as their peers.

Chaplin and Conner (2007) define questioning in mathematics classrooms as a type of math talk. Their framework included ""(1). *Revoicing*: 'So you're saying…is that right?', (2) *Repeating*: 'Can you repeat what _____ just said?', (3) *Eliciting Students' Reasoning*: 'Do you agree or disagree and why?', and (4) *Adding On*—'Can anyone add to this conversation?'" (p. 120-122). Through awareness and use of these different talk moves, teachers can gain further insight into student thinking. Intentional use of questioning can serve as a platform for students to learn from each other. Furthermore, student misconceptions and gaps in their understanding can be revealed and addressed through the strategic use of questioning.

What's New about Posing Purposeful Questions

In Principles to Actions, NCTM synthesized previous questioning frameworks into four different question types: "gathering information, probing thinking, making the mathematics visible, and encouraging reflection and justification" (p. 36-37). As mathematics teachers, we want to understand each type of question and then use each

type intentionally and strategically. In the following sections each type of question is explained and then planning strategies are offered so that you can incorporate these questions effectively into your teaching.

Types of Questions Defined by NCTM (2014)

Gathering information. These types of questions are the most basic level of questions that teachers can ask. *Gathering information* questions require students to restate the facts that they have learned. For example, students may be asked to identify a shape based on a picture presented during the lesson. Students may be asked to define a mathematical term or recall a formula to calculate volume. Providing answers to these types of lower level questions may not provide much insight into the students' thinking but gives teachers feedback about their students' ability to recall and recite factual information.

Probing thinking. When teachers ask *probing thinking* questions, students have the opportunity to explain their thinking. For example, the teacher may ask students to simply state the procedures used to solve a problem. Teachers may also ask students to show their thinking through diagrams and manipulatives or to verbally explain their thinking in a variety of ways. When students answer the *probing thinking* questions, teachers are able to gain insight into students' thinking.

Making the mathematics visible. These types of questions provide students with an opportunity to engage in discussion about mathematical structures. Students talk about the structure of a problem and the connections that they see to other areas of mathematics. Students may be asked how the model that they made represents an addition equation. When students give answers to *making the mathematics visible* questions, teachers gain insight into student thinking about mathematical relationships.

Encouraging reflection and justification. These questions encourage students to provide a rationale for their thinking. When a teacher asks an *encouraging reflection* question, students must synthesize information to provide a "case" for their actions and the way that they have arrived at their answer. Students must explain why their solution works and how it may be the same as or different from another solution. Student responses to the *encouraging reflection and justification* questions provide teachers with an in-depth understanding of students' ability to engage in high order thinking and mathematical meaning making

In addition to encouraging teachers to include the four different types of questions in their mathematics lessons, NCTM supports teachers concentrating on their questioning patterns. Herbal-Eisenmann & Breyfogle (2005) offer two types of questioning patterns utilized in mathematics classrooms: funneling and focusing. Funneling occurs when teachers ask students multiple questions with a predetermined end in mind. Through this type of approach, students' original thinking is not emphasized. To the contrary, teachers' thinking takes center stage as they direct students down a path of the "teachers' way" to solve the problem. Oftentimes, this approach can be mistakenly viewed as scaffolding. Yet funneling is different than scaffolding because the discussion is geared toward finding the correct answer instead of seeing the significance of the questions being asked. When funneling is a staple in the classroom, students often see question asking as the role of the teacher rather than a means to encourage their thinking.

Funneling also limits classroom discourse and students' ability to facilitate the connections they see between their prior knowledge and new concepts they are learning.

The questioning pattern called focusing allows students to explain their thinking. Intentional use of focusing requires students to engage in classroom discourse through the sharing of their thinking and listening to their peers. Students must clearly communicate their thoughts in a manner that can be understood by their classmates and teachers. Some of the benefits of using focusing includes: (a) allowing teachers to gain further insight into the understandings, misconceptions, and gaps that their students possess about mathematics topics (b) providing multiple opportunities for students to engage in meaningful mathematical discussions. Additionally, the use of focusing sends the message to students that their thoughts and contributions are valued. Herbal-Eisenmann and Breyfogle state, "Although funneling is a more common classroom interaction pattern, we maintain the long-term benefits of focusing make it imperative that mathematics teachers 'focus' more often" (2005, p. 487).

Planning for the Questioning

There's a rather famous quotation by legendary football coach Paul "Bear" Bryant that says, "It's not the will to win that matters...everyone has that. It's the will to prepare to win that matters." This highly successful coach is making the point that all football players want to win but what separates the great players from the mediocre ones is the ability to commit to the behind-the-scenes preparation that results in the game day win. Similarly, in the context of the mathematics teaching, most teachers agree on the importance of the intentional and strategic use of the four question types from Principles to Actions (NCTM, 2014) and the use of a focusing pattern as opposed to a funneling pattern, but how many teachers prepare, or plan, for this strategic questioning?

As you think about your questioning practices, what types of questions do you pose during your math lessons? When considering the four questions types, to which category does the majority of your questions belong? Do you find yourself asking more gathering information questions? If so, you are not alone. Previous research findings highlighted that teachers frequently asked lower order thinking questions during their mathematics lessons (Wimer, Ridenour, Thomas, & Place, 2001). Higher order thinking questions require students to synthesize and evaluate information that that has been presented to them. Teachers typically ask these types of questions (ie. encouraging reflection and justification) far less frequently. When thinking about the patterns that you use to ask questions, do you funnel or do you focus? How much of the discourse in your classroom is lead by you or your students? We have created a tool called the Posing Purposeful Questions Planning Tool (PPQPT) to assist teachers through the thought process needed to plan for effective questioning.

How to use the Posing Purposeful Questions Planning Tool (PPQPT)

The initial part of this tool includes identifying the mathematics content and practice standards that your mathematics lesson will target. These provide the foundational pieces for the lesson: what your students will learn (the content) and how they will demonstrate their learning (practice standards).

The next section of the PPQPT encourages you to think about the prior knowledge students may possess that relates to the new content that they will be learning.

This knowledge serves as the foundational skills that students will build upon as they encounter the new content. Gaps in this knowledge or misconceptions that students may possess can hinder their ability to understand and make connections to the new material. Identifying these pieces can allow you to create a plan to address these misconceptions and gaps.

The next section of the tool is where you can list out the questions that you want to ask during your lesson. Each question type has its own section in order to encourage you to challenge yourself to create questions in each of the categories. As you list these questions, think about the purpose of the question. Why are you asking that question? What information will you gather by asking this question? What will you learn about your students by asking this question? What will you do with the information that you learned? Remember this practice includes posing questions in an intentional way. It is not about the number of questions you ask, it is about asking questions in a meaningful way to gain insight into the way that your students think mathematically.

This tool also includes a reflective section. This is the place where you think about the questions that you planned to ask your students. Did you ask the question? If you did, what were the students' responses? Did their responses match your thinking? What did you learn about your students' thinking as you reflected on their responses? What did you do as a result of what you learned?

We encourage you to use the tool to plan by yourself or with your colleagues and to take notes while you are teaching. You may want to have a colleague come in and observe you teaching a math lesson. Have your colleague mark on the PPQPT which questions you asked and what the student responses were. This valuable information can help you gain further understating on your current questioning practices. If this is not possible, audio record or video record a math lesson. Review your recording, and pay close attention to the questions that you asked your students. Categorize them based on the previously defined question types. What were your findings?

Next Steps

You may be wondering how can you accomplish these tasks? With limited time for planning and instruction, where does this all fit in? Start with learning more about your current questioning strategies. Through the use of the PPQPT, what did you discover about yourself? Identify your questioning pattern (funneling or focusing). Which students do you pose which questions to? What did you learn about your students? How are your students responding? Which students are responding to the questions? How do you use your students' responses? After gaining a better understanding of your current questioning practices and your students' responses, develop goals for yourself.

As you plan, begin to anticipate student responses. Then ask yourself, if a student responds in that way, what would you do? Think about ways that you can use "focusing" instead of funning when questioning your students. Encourage them to dig deeper with their explanations through the use of questions that require students to justify their strategies as well as their answers. When selecting the tasks that your students will solve, consider if those tasks provide opportunities for you to pose a variety of questions to your students?

In Principles to Actions, NCTM highlighted a variety of teacher and student actions that foster the intentional implementation of this practice. Teacher actions include asking questions that create connections in student thinking. In addition to asking questions from all four categories, ask questions that help students see and discuss the mathematics concepts. Strategic use of adequate wait time is also an integral component of this practice. Wait time provides time for students to process the questions asked and formulate a response. It also provides an opportunity for teachers to process their students' responses prior to making their next teaching move.

As teachers employ these strategies, students expect to be questioned. They also know that the expectation is for them to answer questions and share their thinking. Students also begin to understand that they are expected to be active participants in the classroom discourse. They know that they are to engage in active listening to their peers and provide feedback through their comments or by asking additional questions to gain a better understanding of their peers thinking. Through effective engagement of this practice, students also realize that simply providing an answer to questions is not enough. Students must justify and explain their reasoning. This type of response requires students to take the time to think deeply instead of swiftly providing superficial explanations.

Summary

Asking purposeful questions requires teachers to plan for the inclusion of different types of questions in their lessons in addition to paying attention to their questioning patterns (NCTM, 2014). Although researchers have identified a variety of frameworks to describe the different types of questions, NCTM encompassed these frameworks into four general types of questions to help teachers gather varying levels of information about student thinking and understanding of mathematical conepts. Investigation of current questioning practices, setting goals, and developing a plan to meet these goals can enhance teachers' ability to engage in this mathematical teaching practice. Additionally, enlisting the assistance of peers such as the school's mathematics coach or other colleagues can further help on this journey toward asking questions with a purpose.

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Posing Purposeful Questions Planning Tool (PPQPT)		
Teacher:	**Grade Level:** **Lesson Topic:**	**Date of Lesson:**
Student Learning Goals		
Mathematics Content Standard(s)	Mathematical Practice Standard(s)	
Prior Knowledge:		
Vocabulary:		
Possible Misconceptions:		

<u>Questions Types: From Principles to Action (NCTM, 2014)</u>
List questions for each of the four types that you want to ask during your lesson. Indicate a Y/N if you actually asked the question in class, and take notes on student responses.

	List the Questions you want to ask in class	Y/N	Student Responses
Gathering information			
Probing thinking			
Making the mathematics visible			
Encouraging reflection and justification			

Louissaint, Gregory C
Project Made Fun: Data Analysis and Statistics for Middle School Students
Dimensions in Mathematics
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Project Made Fun: Data Analysis and Statistics for Middle School Students

Gregory C. Louissaint

According to the National Council of Teachers of Mathematics (NCTM, 2014) Math Standards and Expectation for Data Analysis and Probability grades 6 - 8, students are supposed to collect and interpret data taken from different populations. Students should also learn how to create graphs and other representational formats, for example histograms. With data provided, they can utilize their observational skills and use statistics to make inferences. ,In 1986, the Board of Directors of the NCTM established a Commission on Standards for School Mathematics to help improve the quality of school mathematics (Sorto, 2011). The NCTM Board of Directors published the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) and later *Principles and Standards for School Mathematics* (NCTM, 2000), and placed, for the first time**,** statistics and probability on an equal footing with numeration, measurement, algebra, and geometry in their importance in Kindergarten through grade 12. Sorto (2011) further stated that The National Assessment of Educational Progress Frameworks (NAEP) have been including statistics since 1973. Since then, the percentage of items classified as data analysis, statistics, and probability has almost doubled in grade 8 and more than tripled in grade 12 (Shaughnessy, 2007). Results from these assessments over time show that students' abilities to read tables and graphs, and their success at computing measures of center, are on the rise. However, their conceptual abilities to interpret and draw conclusions from graphs and to identify which measure of center is more appropriate, are much weaker than their procedural skills (Tarr & Shaughnessy, 2007). I noticed that not many research articles focused on providing instruction for data analysis, probability and statistics from a mathematics standpoint. I found this very interesting because most standardized tests contain data analysis (for example; FCAT, ACT, SAT, GRE, GKT, and GMAT), but very little focus has been placed on educating and building student's data analysis and reasoning skills.

Project Made Fun's Purpose

While reviewing the literature on this topic, one article (McLaughlin, 2013) focused on analysis and interpretation of real world data by providing students with bar graphs, which the students used to answer questions about the data. Students were advised to look at the bar graph and draw claims from the data and inferences were made. The students were divided into groups to encourage a collaborative effort. Another article (Brosnan, 1996) explained how the mathematics subject matter in the school system did not have specialist in the state of Ohio. So volunteers came together to form a group to develop a curriculum that would be math student centered, provide open communication

within the class, and provide opportunity for cooperative-learning. The students learned how to evaluate statistical data from activities that were done using M&M's. "This activity also included estimation, measurement, multiple visual representations, reasoning, communication, making connections, and statistics again in alignment with the Curriculum and Evaluation Standards (NCTM, 1989)." The students learned to love and enjoy mathematics due to their enjoyment of the activities; which were more interactive and real-world based.

Very little instruction has been provided for data analysis, probability and statistics from a mathematic standpoint. Therefore, I decided to create a project with this focus. What I have also noticed within the Common Core State Standards (NGA & CCSSO, 2010) is that probability and statistics is not being taught at the elementary school level. Probability and statistics is not introduced to students until they reach the fifth grade. I honestly feel that our children should be taught probability and statistics, preferably within their primary school years so they can learn reasoning skills at an earlier age. My project will assist students in making mathematic enjoyable and develop data analysis as well as reasoning skills.

This project was carried out with middle grade level students, focused on data analysis and statistics used in mathematics. My students learned how to interpret data that was provided to them. The statistical data was derived from the Disney theme park ticket website for Florida Residents, Orlando theme park compiled data, and from local school county data regarding student population and student-teacher ratios. These data were selected to make learning more interesting and exciting for the students. My students love theme parks, they love learning about the area they live in, and they love to play with their classmates. Other similar topics and data sources could be used for a specific place of students' interest

Students Previous Knowledge Prior to Project

I focused specifically on my 6th grade students. My students have had previous experience creating graphs and charts; understood how to complete statistical calculations such as: mean, median, and mode; interpret data provided, as well as exhibit reasoning skills, perform basic mathematics calculations and had the ability to make inferences from data that was provided. The Common Core State Standards (NGA & CCSSO, 2010) involved in this project are the following:

MACC.6.SP.1.2 MACC.6.SP.1.3 MACC.6.SP.2.5
(http://www.cpalms.org/Public/search/Standard#0)

Project Made Fun's Lesson

First, I announced to the class that they would be required to complete an in-class group project. I advised the class that the name of this project was "Central Florida Made Fun" to build their interest. The class was also advised that we would break the class up into 6 groups of 3. Each student pulled letters out of a hat that contained letters; there were 3 of each letter available. Then the class was split into their randomly assigned groups. Once they were all settled I provided them with statistical data sheets, project worksheets, and a calculator. I advised my students that they would work together in a

collaborative effort between classmates. Class collaboration would lead to the development of my student's interpersonal skills.

Project Made Fun's Lesson Process

The groups were advised that the first two teams to complete their exercise would get a prize. The other groups were to get concession prizes, but this was not announced and would be a surprise to keep up class morale. The first central tendency activity included Worksheet 1. (Note that the data referenced as Fig. 1, Fig 2 and Fig 3 have been condensed into Table 1 for this article) The students filled in the worksheet, by answering the questions and then calculated the mean, median, and mode for both 6^{th} grade population and student teacher ratios for each middle school. The entire class enjoyed the environment of friendly competition and worked well with each other to get the assignment completed. The first activity built up enthusiasm to compete during the upcoming activity.

Name of Middle School	**6^{th} grade students**	**7^{th} grade students**	**8^{th} grade students**	**total students**	**total teachers**	**student teacher ratio**
Carver	296	290	265	581	48	18:1
Clermont	230	227	243	700	41	17:1
East Ridge	374	360	349	1083	63	17:1
Eustis	328	372	357	1057	62	17:1
Gray	299	336	310	345	54	18:1
Mt. Dora	260	231	229	720	42	17:1
Oak Park	190	200	171	561	35	16:1
Tavares	348	339	322	1009	58	17:1
Umatilla	203	288	220	691	40	17:1
Windy Hill	364	379	359	1102	60	18:1

WORKSHEET 1

Review Figures 1, 2, and 3 and locate the 6th grade student totals and student teacher ratios for each Lake County Middle School. Document the totals on the worksheet and calculate the Mean, Median and Mode for the 6th grade student total and for the student teacher ratio.

Schools	6th grade	Student Teacher Ratio
Carver Middle School	296	18
Clermont Middle School	230	17
East Ridge Middle School	374	17
Eustis Middle School	328	17
Gray Middle School	299	18
Mt. Dora Middle School	260	17
Oak Park Middle School	190	16
Tavares Middle School	348	17
Umatilla Middle School	203	17
Windy Hill Middle School	344	18
	2892 ÷ 10	172 ÷ 10
Mean	289	17
Median	279	17
Mode	NONE	17

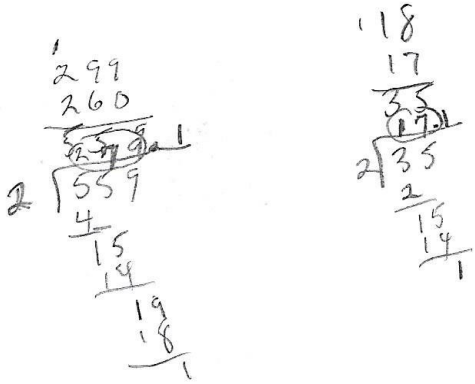


Fig. 4

The second central tendency activity includes data and questions. The students collaborated and calculated the mean, median, and mode for the data provided using the calculator.

2012 Florida Theme Park Attendances

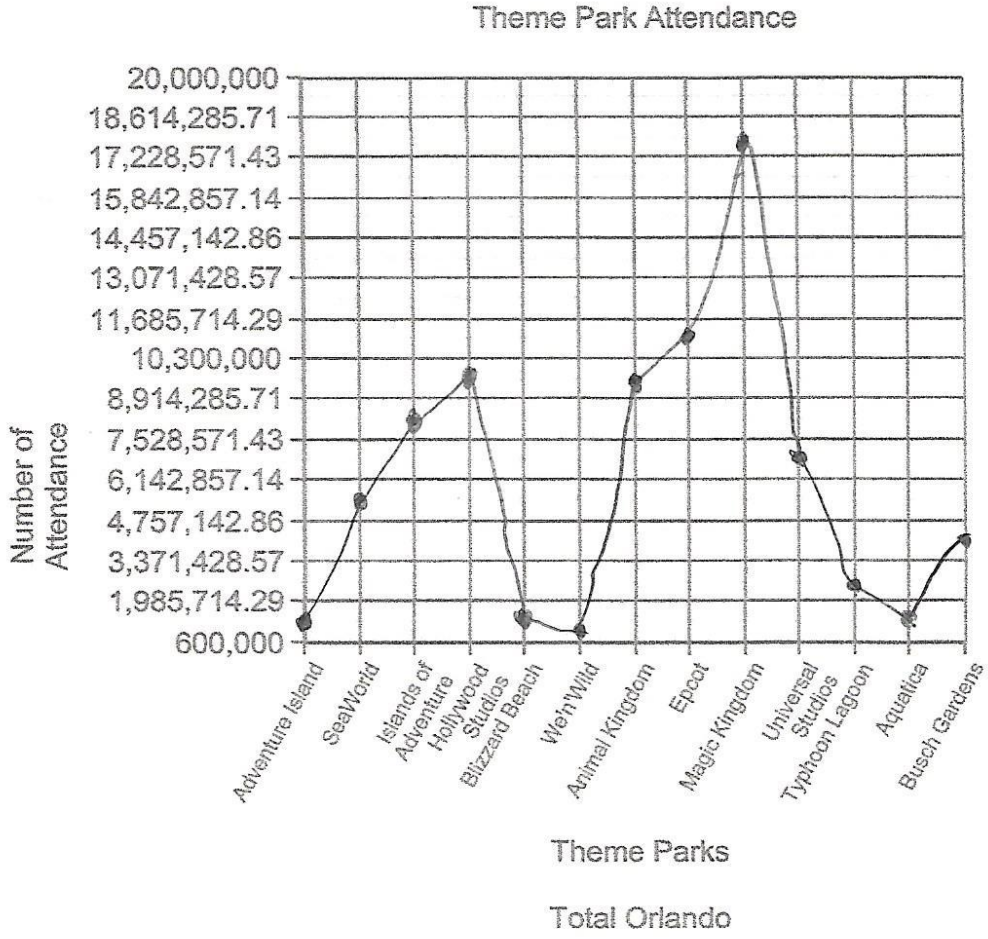
		2012	2011
Magic Kingdom	2.3%	17,536,000	17,142,000
Epcot	2.2%	11,063,000	10,825,000
Animal Kingdom	2.2%	9,998,000	9,783,000
Hollywood Studios	2.2%	9,912,000	9,699,000
Islands of Adventure	4.0%	7,981,000	7,674,000
Universal Studios	2.5%	6,195,000	6,044,000
SeaWorld	4.2%	5,358,000	5,141,000
Busch Gardens	1.5%	4,348,000	4,284,000
Typhoon Lagoon	2.0%	2,100,000	2,058,000
Blizzard Beach	2.0%	1,929,000	1,891,000
Aquatica	2.5%	1,538,000	1,500,000
Wet 'n' Wild	2.0%	1,247,000	1,223,000
Adventure Island Tampa	1.1%	651,000	644,000
All Parks annual gate	2.5%	79,856,000	77,908,000

Source Data TEA

1) Based on the theme park attendance what it the **Mean** of the total attendance in 2011? 5,993,000
2) Based on the theme park attendance what it the **Mean** of the total attendance in 2012? 6,143,000
3) Based on the theme park attendance what was the **Median** of the total attendance in 2011? 5,141,000
4) Based on the theme park attendance what was the **Median** of the total attendance in 2012? 5,358,000
5) Based on the theme park attendance what was the **Range** of the total attendance in 2011? 14,498,000
6) Based on the theme park attendance what was the **Range** of the total attendance in 2012? 14,885,000

Fig. 5

This data was also to be used to graph a line graph (see Fig.6) identifying the theme park attendance for 2012. My students did a great job with this activity as well. This activity just took a little longer for them to complete due to the graphing, especially because the list was not in alphabetical order.



The final part of the activity featured basic math calculations using Fig. 7 as a point for cost reference. For this activity, I provided all of my students with their own individual calculator, so they could complete the calculations themselves. The students were still collaborating with their group members, which allowed them to gather reasoning skills if one team member came up with the incorrect answer the other members would help them and explain how they reached the correct answer.

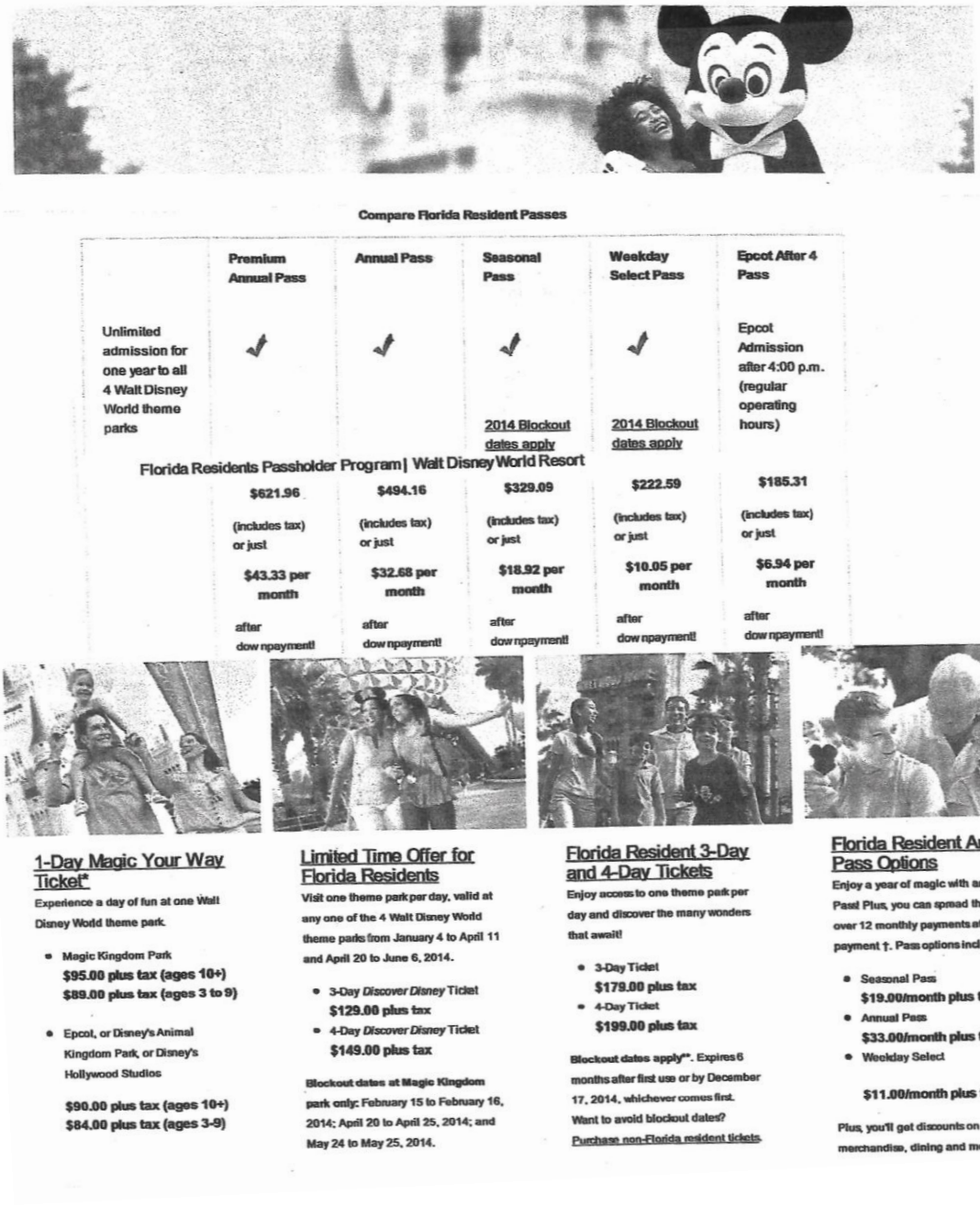

Compare Florida Resident Passes
Premium Annual Pass
Annual Pass
Seasonal Pass
Weekday Select Pass
Epcot After 4 Pass
Unlimited admission for one year to all 4 Walt Disney World theme parks
Epcot Admission after 4:00 p.m. (regular operating hours)
2014 Blockout dates apply
2014 Blockout dates apply
Florida Residents Passholder Program | Walt Disney World Resort
$621.96 (includes tax) or just $43.33 per month after down payment!
$494.16 (includes tax) or just $32.68 per month after down payment!
$329.09 (includes tax) or just $18.92 per month after down payment!
$222.59 (includes tax) or just $10.05 per month after down payment!
$185.31 (includes tax) or just $6.94 per month after down payment!
1-Day Magic Your Way Ticket*
Experience a day of fun at one Walt Disney World theme park.
Magic Kingdom Park
$95.00 plus tax (ages 10+)
$89.00 plus tax (ages 3 to 9)
Epcot, or Disney's Animal Kingdom Park, or Disney's Hollywood Studios
$90.00 plus tax (ages 10+)
$84.00 plus tax (ages 3-9)
Limited Time Offer for Florida Residents
Visit one theme park per day, valid at any one of the 4 Walt Disney World theme parks from January 4 to April 11 and April 20 to June 6, 2014.
3-Day Discover Disney Ticket
$129.00 plus tax
4-Day Discover Disney Ticket
$149.00 plus tax
Blockout dates at Magic Kingdom park only: February 15 to February 16, 2014; April 20 to April 25, 2014; and May 24 to May 25, 2014.
Florida Resident 3-Day and 4-Day Tickets
Enjoy access to one theme park per day and discover the many wonders that await!
3-Day Ticket
$179.00 plus tax
4-Day Ticket
$199.00 plus tax
Blockout dates apply**. Expires 6 months after first use or by December 17, 2014, whichever comes first.
Want to avoid blockout dates? Purchase non-Florida resident tickets.
Florida Resident Annual Pass Options
Enjoy a year of magic with an Annual Pass! Plus, you can spread the cost over 12 monthly payments after down payment †. Pass options include:
Seasonal Pass
$19.00/month plus tax
Annual Pass
$33.00/month plus tax
Weekday Select
$11.00/month plus tax
Plus, you'll get discounts on merchandise, dining and more!

Figure 7

Worksheet 2

1) Graph the attendance of all the theme parks in 2012 from Fig. 5 using Fig. 6.

2) Calculate the mean, median, and mode of the 6th grade population for all 10 Lake County Middle Schools. Fig. 1, 2, and 3 (Add all 6th grade class totals and divide by 10 {N/10=Mean})

3) Calculate the mean, median, and mode of the 6th grade student to teacher ratio for all Lake County Middle Schools. Fig. 1, 2, and 3

4) What was the difference in attendance between years 2011 and 2012 at Magic Kingdom Fig. 5? 394,000

5) What was the difference in attendance between years 2011 and 2012 at Epcot Fig. 5?
238,000

6) What was the attendance at Universal Studios in 2012 Fig. 5?
6,195,000

7) What was the attendance at SeaWorld in 2011 Fig. 5?
5,141,000

8) What was the attendance at Animal Kingdom in 2012 Fig. 5?
9,912,000

9) Using Fig. 7 how much will it cost for a family of 4 to purchase 3 Day passes?
$714

10) Using Fig. 7 how much will it cost for a family of 5, 2 adults and 3 children ages 4, 7, and 12 to purchase a 1 day ticket? $463

11) Using Fig. 7 how much will it cost for family of 3 to purchase annual passes?
$1,482.48

12) Using Fig. 7 how much will it cost for family of 3 to purchase weekday select passes?
$667.77

Fig. 8

Adaptations and Extensions of the Data Analysis activity

The activities offered in this article can be utilized for all middle school levels, and activities can be created to calculate standard deviation and other mathematical problems dealing with probability and statistics. Data analysis can take on so many areas of study. In addition, experiments can be conducted within the classroom to create the data needed to complete statistical calculations making the activity more engaging. As stated before this sort of activity can be used with a number areas of interest to maintain student interactivity. We are in the internet age where a student can investigate anything that they wish to learn about and apply mathematically. A way that teachers can adapt these activities is by adding an inference sections that will require our students to draw conclusions regarding the data that they are provided, or the data that they have received from their experiment.

Conclusion

At the conclusion of this activity the students fully grasped how to interpret data, graph data, and how to calculate central tendencies such as the mean, median, and mode. The students also learned more about the theme parks in the Central Florida area, as well as the cost their parents incur while taking their families to the parks. The students also learned more about other schools in Lake County regarding the class populations at their same grade level. My students really enjoyed the activities, winning prizes, and working with their peers.

I feel that more projects should be practiced to increase the knowledge of our student on the subject matter of probability, statistics, and data analysis.

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Gregory C. Louissaint is a graduate student enrolled in the Master of Arts in Education – Middle School Mathematics Program at the University of Central Florida. Gregory is interested in how to teach students to use probability, statistics, and data interpretation to apply to real world scenarios. He wishes to make mathematics a more enjoyable subject to learn for his students.

Editor's Note: Gregory had completed the activity with his class and written the first draft of this article at a time before we all were aware that Florida had dropped the common core and introduced the Florida Mathematics Standards that we are currently using. The timing of his article being published in this issue was not something within Gregory's control. I hope that the creativity Gregory has shown here inspires other teachers to use what is at hand and of local interest to enhance their own lessons.

Mathematics Educator of the Year
Kenneth P. Kidd Award

Mathematics educators are eligible if they meet the following criteria, as established by the FCTM Board of Directors.

1. The person shall have been actively involved in mathematics education in Florida for at least ten (10) years.
2. The person has been professionally active and has made a significant contribution at the local, state, and/or national level.

For the nominee, please send the following information:

a. Name, home address, and phone number
b. Work address and phone number
c. Educational Background
d. Experience in the field of mathematics education
e. Professional activities
f. Your name and address.

Nomination forms are available on the web site: www.fctm.net

For additional information contact: Susan Lee, FCTM Grants and Awards Chair
Rebecca Lee @ ocps.net

Completed Packets are due by April 15, 2016.

Mathematics Educators of the Year
Past Kenneth P. Kidd Award Recipients

1976 Mary Nesbit, Dade County, FL
1977 Ruth Bower, West Palm Beach, FL
1978 George Rule, Orlando, FL
1979 Baker Holman, Pensacola, FL
1980 Mary Elizabeth Sullivan, Dade County, FL
1981 Ernest Burgess, Boca Raton, FL
1982 JoAnne Taber, Miami, FL
1983 Arthur T. Minor, Palm Harbor, FL
1984 Bill E. Jordan, Winter Park, FL
1985 Richard A. deAguero, Miami, FL
1986 Herbert Johnson, Clearwater, FL
1987 Laurence R. Wantuck, Hollywood, FL
1988 Dr. Betty Lichtenberg, Temple Terrace, FL
1989 Dr. Elroy Bolduc, Gainesville, FL
1990 Dr. Douglas Brumbaugh, Chuluota, FL
1991 Dr. Tom Denmark, Tallahassee, FL
1992 Dr. Donovan Lichtenberg, Temple Terrace, FL
1993 Dr. Charles Andy Reeves, St. Petersburg, FL
1994 Renee Henry, Tallahassee, FL
1995 Dr. Don Bernard, Gainesville, FL
1996 Margaret Hackworth, Pinellas County, FL
1997 Dr. Charles Aplin, Ft. Walton, FL
1998 Nicky Walker, Milton, FL
1999 Barbara Nunn, Coral Springs, FL
2000 Suzanne Davis, Largo, FL
2001 Carol Newman, Plantation, FL
2002 Roger L. O'Brien, Bartow, FL
2003 Karen R. Swick, Lake Worth, FL
2004 Dr. Denisse Thompson, Lutz, FL
2005 Dr. Karol Yeatts, Miramar, FL
2006 Susan McNally, Ft. Myers, FL
2007 Carol Martin, Lake City, FL
2008 Carole Halka, Ft. Lauderdale, FL
2009 Debbie Gillis, Okeechobee County, FL
2010 Ann Marie Hubscher Rockledge, FL
2011 Nancy Kinard, Tequesta, FL
2012 Dr. Lou Cleveland, Marianna, FL
2013 Charlene Kincaid, Milton, FL
2014 Jill Nielsen, New Port Richie, FL
2015 Joyce Hawkins, Hallandale Beach, FL

Applications for all **Grants and Awards** are now accepted online
Please visit the **Grants & Awards** section of our web site: www.fctm.net

Tom Denmark Teacher Enhancement Grant

In the 1990's the FCTM Board established four annual grants in recognition of Dr. Tom Denmark, a long time active FCTM member. Through these grants, the Board hopes to encourage participation at annual FTCM conferences as a way to provide excellent professional development for FCTM members. Enhancement Grants for up to four teachers to attend the annual FCTM Conference will be awarded, one each to a Primary (Pre-K – 2) teacher, an Intermediate (3-5) teacher, a middle School (6-8) teacher and a high school (9-12) teacher. **The annual deadline for applications is April 15**. Recipients of the awards will be notified in late May of their selection. They will be required to submit a written report on their session and workshop experiences encountered at the Annual Conference along with their receipts for reimbursement, no later than November 30. The FCTM treasurer will send a check to each recipient upon receipt of these materials.

Each recipient of this grant may be reimbursed up to $500. This will help to cover the cost of registration, room and transportation to attend the Annual Conference. Any additional monetary expenses over the $500 grant that are incurred by the recipient will be at their own expense. It is hoped that if added funding is necessary the recipient may be successful in seeking other support.

** This grant money may not be used for FCTM membership dues, food or substitute pay.

Who May Submit an online Application:

1. Any full time classroom teacher currently certified and teaching in Florida may apply.
2. Applicants must have at least a bachelor's degree.
3. Applicants must be teaching mathematics at the time of the application and anticipate teaching mathematics during the following year.
4. Applicants must be current members of FCTM.
5. Current FCTM Board members and past recipients may not apply.

Kenneth Kidd Grant

FCTM sponsors mini-grants of up to $500 for projects to improve mathematics education

The Board is looking for high quality projects that will improve mathematics education at any level. Projects which have been funded in the past include writing guidelines for competitions at the elementary level, developing monthly activities for each grade level in an elementary school, organizing community resources, etc. Project ideas will be judged on originality, uniqueness, and the potential impact on teachers and students.

Any FCTM member with **four years of experience in the State of Florida** may apply. The annual deadline for applications is **April 15**. The person receiving the grant will submit a written reflection about the project's implementation and success, to be considered for publication in FCTM's journal or newsletter.

Apply online with the following information:

1. Experience teaching mathematics (beginning with the current year), School, level, Dates
2. Narrative (500 words maximum) to include
    a. specific objective(s)
    b. description of products (if any)
    c. how you will determine the success of your grant
3. Budget Outline including proposed timeline for expenditure of grant funds
4. Name of reference supporting the grant award (principal, department chair. Mathematics supervisor, college professor). Your reference may be contacted for verification.

Lichtenberg Pre-service Educator Grant

Any Florida college or university full-time, pre-service educator in his /her junior or senior year may apply for this grant. **The annual deadline for application is September 1**. The grant will reimburse awardees up to $500 for transportation, room and registration expenses to attend the FCTM Annual Conference in the fall. Pre-service educators who receive this grant will be required to write about their experiences in a form suitable for one of FCTM's publications prior to reimbursement. An electronic copy of the manuscript and receipts for reimbursement must be submitted to the FCTM treasurer no later than December 1. Up to four grants may be awarded each year. It is expected that all awardees will be from different institutions.

Apply online and respond to the following:

1. Describe the type of teacher of mathematics (Pre-K to 12) you would like to become.
2. Explain how attending the FCTM Conference will help you attain that goal.
3. How will you share what you have learned with other pre-service mathematics educators at your college/ university?

Don Bernard Enhancement Grant

In 2010 the FCTM Board established two annual grants in recognition of Dr. Don Bernard, a long time active FCTM member who supported mathematics teachers in a variety of ways. Through these grants, the Board hopes to encourage participation at annual FCTM conferences as a way to promote mathematics professional development for FCTM members who provide support to mathematics classrooms though not a full time classroom teacher.

Two grants will be awarded to attend the annual FCTM Conference. The annual deadline for applications is April 15. Recipients of the awards will be notified in late May of their selection. They will be required to submit a written report on their session and workshop experiences encountered at the Annual Conference along with their receipts for reimbursement, no later than November 30. The FCTM treasurer will send a check to each recipient upon receipt of these materials.
Each recipient of this grant may be reimbursed up to $500. This will help to cover the cost of registration, room and transportation to attend the Annual Conference. Any additional monetary expenses over the $500 grant that are incurred by the recipient will be at their own expense. It is hoped that if added funding is necessary the recipient may be successful in seeking other support.
** This grant money may not be used for FCTM membership dues, food or substitute pay.

Who May Submit an online Application:

1. Anyone who provides support to mathematics classrooms though not a full time classroom teacher.
2. Applicants must have at least a bachelor's degree and hold a valid Florida teaching certificate.
3. Applicants must be current members of FCTM.
4. Current FCTM Board members and past recipients may not apply.

AFFILIATE GROUP FOCUS

The second Renee Henry Leadership Conference provides opportunities for affiliate group members to network with each other and the FCTM Board. It is also a chance for those who might want to form an affiliate group to see what has being done in other affiliates around the state, and find out what needs to be done to create another affiliate group.

This fall the conference will be held on September 17 and 18, 2016 at the Hilton Altamonte Springs, just north of Orlando Florida

Interactions at past leadership conferences have allowed group leaders to share information and thus avoiding to have to invent activities and outreach efforts completely on their own. One goal of FCTM is to have many vibrant and active affiliate groups from all around the state. Expect to find more information on our web site as the date gets closer

The FCTM web site does have a list of affiliate groups and some of them have posted their own constitution.

For answers to questions or just more information on the FCTM web site at the days get closer to the meeting. For more information please contact either

Claire Riddell at clairemarieriddell@gmail.com or
Robert Curran at curranr1@duvalschools.org.

Another Reminder

Florida Council of Teachers of Mathematics
64th Annual Conference

Imagine the Possibilities…

Mathematics

to Infinity and Beyond!

October 20 – 22, 2016
Doubletree by Hilton Orlando at SeaWorld

Keep up to date by visiting the web site at www.fctm.net

Florida Council of Teachers of Mathematics
Membership Application
(Individual or Affiliate Group)

Florida Council of Teachers of Mathematics (FCTM) – Check membership option and amount.

_____ **One** Year Membership - $25.00

_____ **Two** Year Membership - $45.00

_____ **Five** Year Membership - $100.00

_____ Full-time Student **One** Year Membership - $12.50
(also send an official class schedule)

Write your check for the appropriate amount, payable to **FCTM**, and mail the check and this form to:

Diane Gard
FCTM Membership
PO Box 411884
Melbourne, FL 32941-1884

Please complete the following; help us keep our records up to date.

NAME _____

MAILING ADDRESS _____

CITY_____**STATE**_____ **ZIP** _____

PREFERRED TELEPHONE NUMBER _____

PREFERRED EMAIL _____

SCHOOL / ORGANIZATION_____

COUNTY FOR VOTING PURPOSES _____

Please be sure to provide an e-mail address so that your membership can be confirmed and your Region Director can contact you.

NOTE: Photos taken by authorized FCTM agents of activities and participants during FCTM conferences and meetings are the property of FCTM. Photos may be used for promoting or displaying FCTM activities in print or digital media.

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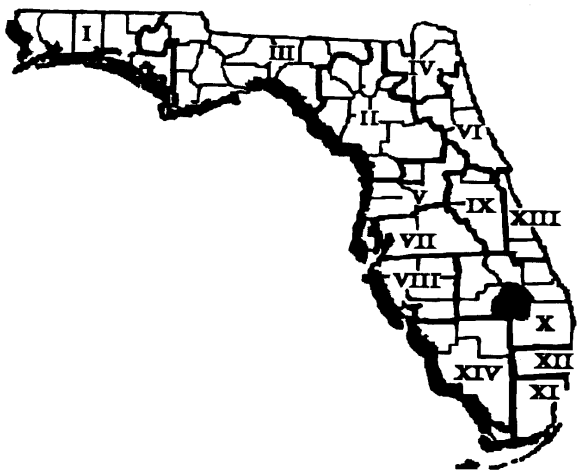

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