

Carolyn's Experiences from the NKY FAME Externship

Participating in the NKY FAME externship has been one of the most incredible experiences I have had the opportunity to participate in. During the first portion of the externship, the conference, I attended a session for Mathematics. This allowed me to meet current teaching professionals and learn from their experiences and lesson plans from the previous year. During the three day portion of the externship, I had the opportunity to work with a local advanced manufacturing company. The company allowed me to meet with individuals who were in the various departments within the manufacturing plant. Through meeting with these individuals I was able to identify soft skills my students will need to become workforce ready. This opportunity was eye opening to the advancements made in the production field. These businesses are excited to work with classroom teachers because they believe it is a mutually benefitting partnership.

Carolyn's Lesson Plans

During the last three days of the externship I was unavailable to attend. However, I did create two different lesson plans based off the 6S or 6 sigma organization model. This lesson also includes the 8D problem solving method. My second lesson addressed a need for students to be familiar with the Excel program, specifically how to create pivot tables. The need for familiarity with Excel, with specific concentration on pivot tables was brought to my attention by one of the human resource personnel at the company I was partnered with.

NKY FAME **Presented by Anna Wiener and Carolyn Megie**

What is NKY FAME?

NKY FAME is a program for students with an interest in advanced manufacturing. Through this program students can apply for a two-year associate degree program that offers students curriculum dealing with advanced manufacturing ideas as well as a paid work position during their schooling.

These companies are willing to pay for some if not all of the schooling and allow the students to work at their company to gain experience while they are in school.

Students can select a few advanced manufacturing companies in which they are interested. These companies will then panel interview these students and select which students will be valuable assets to their company.

The NKY FAME Externship

Through NKY FAME preservice and service teachers were invited to participate in a seven day externship. The first day was a conference where we learned about NKY FAME and the previous year's experiences and lessons. The next three days members of the externship were placed with advanced manufacturing companies where we were exposed to various positions and opportunities available. The next three days all the teachers came together to create lessons that implemented various advanced manufacturing ideas that can be taken back into the classroom.

Soft Skills Advanced Manufacturing Companies Are Looking For



Interested in Learning More?

If you would like to learn more about Kentucky Fame you can visit their website at: http://kyfame.com/

If you would like access to the lesson plans developed by teachers based of their externship experiences please feel free to email the address below. These lessons are all FREE OF CHARGE!

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The externship was a great experience. The local company that I was placed at took us through the process (start to finish) of when they get in a product proposal. It was interesting to get to hear all the team members' stories and ideas of what they would have liked to see in the classroom that would have helped them now. This also allowed me to create relationships with the companies in the Northern Kentucky area. These companies are more than willing to answer any questions, offer tours to students who are interested in the field, and send any resources for the classroom that they might have. The main takeaway for me was the opportunities that are available to the students and including advanced manufacturing methods into my lessons

There were many issues that the company had that related to difficulties converting between two systems of measurement. The students will learn the measurement conversions between the metric system and the US standard system. From here the students will choose objects around the room they would like to measure. They will estimate these measurements and then actually get up and measure these objects to see how close their estimates were.

The company I was placed at used the scientific method, so I created a lesson centered around this. Each group was given a problem that they company was having relating to heat science. From here the students had to think about solving this problem, think of the materials they would need, and determine how they would test their product. The students will construct their product and test the product. The students would create a commercial promoting their new product to the company.



Anna's Experiences from the NKY FAME Externship

Anna's Math Lesson

Anna's Science Lesson



LAUNCH

The teacher presents the task to the whole class, helping students understand the setting, and clarifies goals and expectations. Here, the teacher wants to give students enough information so that they can do the task — but not give too much away.

Launch Task

The students are each placed at a table with a pile of M&M's. They are then asked to share the M&M's equally between everyone at their table. This is already making a connection to the lesson about sharing pizza equally. Each table is then asked to form a ratio of people at their table to total number of M&M's. They are also asked to record how many M&M's they each got.

Table 1	Table 2	Table 3
4 people to 20 M&M's	4 people to 32 M&M's	3 people to 18 M
5 M&M's each	8 M&M's each	6 M&M's ea

Each table is then asked to share their ratios with the entire class along with how many M&M's they got. I then pose the question, "How does every one feel about their number of M&M"s?" This leads into a class discussion of some students not thinking it is fair one table got more M&M's.

The launch is meant to highlight the idea of favorability. In this situation it is more favorable for students to sit at the table where everyone gets 8 M&M's each. You may ask students why they think one table got more M&M's to pre-assess their strategies for comparing ratios. Some many say table 2 had the largest total M&M's, so that is why each person at that table got the most M&M's. You could then draw attention to table 3 having the smallest number of total M&M's but each person at table 3 got more M&M's than those sitting at Table 1.

Goal Statement

The goal statement gives students the objective for the day and the purpose of the activity.

> "We will be using ratios and the comparison to determine if one is more favorable than the other with a given situation."

Connecting the Launch to the Task

Before letting the class work on the activity I introduced the problem to spark some interest. While explaining the situation given in the activity I highlighted how it was similar to our M&M activity. I also made sure the entire class understood the seating arrangements and knew the pizzas were the same size. They were then told to begin working on problems 1 and 2 with the people at their table.



COMPARING RATIOS:

THE SHARING PIZZA PROBLEM

Emily Jackson Northern Kentucky University

EXPLORE

This is when students work in small groups or pairs to solve the task. The teacher's role is to move among groups, allow students to struggle and make mistakes, and listen closely. Purposeful questioning can give insight to student thinking and help students progress through the problem.

STUDENT SOLUTIONS:

Solution 1

\bigwedge	
(\mathbf{X})	
Each pizza	
is equally cut	
Into 8 slices	

Large Table 4 DIZZAS 4*8=32 total

32 slices = 3.2 slicesper person 0 people

Slices

get more pizza at large table

Questioning:

- Why did you choose to make each pizza 8 slices?
- How did you find the total number of slices at each table?
- How did you find the total number of slices per person?
- Why is the number of slices in each pizza important?

Solution 2

large table	Small Table
$\frac{4}{10} = \frac{16}{40} \text{ people}$	3 = 15 piezas 8 _ 70 people scale up
Scale UP by *4	by #S
The large table would g they have 16 pizzas fi Small table only bas	ive people more pizza because or 40 people where the
[Scale so that number] Of pizzas is equal]	prezent not reput.
large table	Small Table
$\frac{7}{10} = \frac{12}{30}$	$\frac{3}{8} = \frac{12}{32}$
by #3	by #4

Questioning:

- ✤ What do your ratios represent?
- ♦ Why did you choose to scale up?
- How did you choose your scale factor?
- Why is it important for people/pizza to be the same amount for each ratio?
- ✤ Is there another way to use this strategy?

/&M's ich



Solution 3

Large Table $\frac{4}{10} pizzas = \frac{0.4}{1} = 40\%$	$\frac{3\text{ pizzas}}{8\text{ people}} = \frac{0.375}{1} = 37.5\%$
the people at the large tak	ple will get the
most pizza because 0.4 is	larger than 0.375.
Also if we convert it into a	A percentage
407. is larger than 37.52	1.

Questioning:

- ✤ What does your ratio represent?
- ✤ What does your new ratio represent?
- How do you get $\frac{0.4}{1}$ and $\frac{0.375}{1}$?
- What is the significance of both ratios having a 1 to represent people?
- ♦ What units are you using for 0.40 and 0.375?

DISCUSS

This is where the teacher brings the whole group back together to follow up on exploration and make mathematical connections. Students will be purposefully selected to present their solutions in such a way to build off one another. Questioning should be used to help expand student presentations and guide the entire class through the mathematical ideas.

THE CONNECTIONS MADE BETWEEN STUDENT SOLUTIONS

***** Questions After Solution 1:

Can you explain to the class why you made every pizza 8 slices? ♦ What does 3.2 pizza slices mean? Is this possible?

***** Questions After Solution 2:

- the same number of people?
- same scaling up method?

***** Questions After Solution 3:

***** Questions and Connections After All Solutions:



Boston, Melissa, et al. Taking Action: Implementing Effective Mathematics Teaching *Practices in Grades 9-12.* The National Council of Teachers of Mathematics, Inc., 2017.

Why did you choose to scale up? How did you fid your scale factor? • Does everyone see how each ratio compares the number of pizza to

Can someone show a similar way to compare our ratios using the

♦ What are the similarities between solution 1 and solution 2?

♦ What are some similarities between solution 2 and 3? How do your methods of finding a "new ratio" compare to solution

♣ How much pizza is .4 and .375?

Solution 1 found the actual number of slices, is there a way you could now find the number of slices each person will get?

* What are some similarities between these three different methods? • What is important about making comparison between ratios? • What was our most favorable outcome in this situation? From these solutions, we have discussed various methods of comparing between ratios. We have also seen how favorability can play a role in our comparison.





INTRODUCTION

"Initiating Critical Conversations identifies and addresses critical challenges in high school" mathematics to ensure that each and every student has mathematical experiences necessary for his or her future personal and professional success. *Catalyzing Change* addresses the fact that significant numbers of high school students develop unproductive mathematical identities and see little value in mathematics. While the need for mathematical skills is increasing to meet the workplace, post-secondary education requirements, and to ensure active participation in our democratic society."





PURPOSE OF H.S. MATH

Key Recommendation: "Each and every student should learn the Essential Concepts in order to expand professional opportunities, understand and critique the world, and experience the joy, wonder, and beauty of mathematics."

1. Expand Professional Opportunity

It has been a long standing perception that mathematics was only important for STEM-based careers, but in the "information age" more and more fields are using mathematics to advance their work.

2. Understand and Critique the World

Math is all around us and "deeply embedded in many aspects of daily life". Math supports students in their own lives but also allows them to make sense of and challenge the world around them.

3. Experience Joy, Wonder, and Beauty

"[Math] has a cultural heritage and history...[and] should strive to highlight the contributions of a variety of cultures – not just Western contributions."

EQUITABLE STRUCTURES

Key Recommendation: "High school mathematics should discontinue the practice of tracking teachers as well as the practice of tracking students into qualitatively different or dead-end course pathways."

"Three significant structural barriers are directly within educators' sphere of influence:

- Tracking students into course pathways that do not prepare them for continued study of mathematics.
- 2. Tracking teachers in ways that deny certain students access to high-quality instruction.
- 3. Providing inadequate instructions supports both before and during high school for students who would benefit from the support."

CATALYZING CHANGE IN HIGH SCHOOL MATHEMATICS: INITIATING CRITICAL CONVERSATIONS

Jerod Weber, Amelia Floehr



EQUITABLE INSTRUCTION

Key Recommendation: "Classroom instruction should be consistent with research-informed and equitable teaching practices."

"The eight Mathematics Teaching Practices articulated in *Principles to Actions* (NCMT 2014) provide a framework for making connections between high-leverage teaching practices and the development of identity, agency, and competence."

- Establish math goals to focus learning.
- 6. Build procedural fluency from conceptual 2. Implement tasks that promote reasoning and problem solving. understanding.
- 3. Use and connect mathematical representations.
- 4. Facilitate meaningful mathematical discourse.

ESSENTIAL CONCEPTS

Key Recommendation: "Each and every student should learn the Essential Concepts in order to expand professional opportunities, understand and critique the world, and experience the joy, wonder, and beauty of mathematics."

Essential Concepts in:

- Number
- Algebra
- **Connecting Algebra to Functions**
- Functions
- Quantitative Literacy
- Visualizing and Summarizing Data
- Statistical Inference
- Probability
- Measurement
- Transformations
- Geometric Arguments, Reasoning, and Proof
- Solving Applied Problems and Modeling in Geometry



Explain your reasoning.





- 5. Pose purposeful questions.
- 7. Support productive struggle in learning mathematics.
- 8. Elicit and use evidence of student thinking.

Match each graph to a function expressed symbolically and to the verbal description.

i) The function is increasing for all values of x. (ii) The function has an absolute minimum.

(iii) The function is decreasing for all values of x.

- /) The rate of change $(f(x_1) - f(x_2))/(x_1 - x_2)$ is constant for all $x_1 \neq x_2$.
- v) The function has a horizontal asymptote at y = 0.



Key Recommendation: "High schools should offer continuous four-year mathematics pathways with all students studying mathematics each year, including two to three years of mathematics in a common shared pathway focusing on the Essential Concepts, to ensure the highest-quality mathematics education for all students."

- What should count as a mathematics course?
- Require clarity and precision in reasoning
- Have focused and significant mathematics learning standards
- Maintain the integrity of the mathematical standards
- Part of a coherent mathematical learning progression

Integrated Approach Geometry First VS.



"Catalyzing Change in High School Mathematics: Initiating Critical Conversations is designed to open serious conversations and sustained efforts on multiple levels to engage all stakeholders in the system of high school mathematics education in the work improving learning experiences and outcomes for each and every high school student. *Catalyzing Change* offers a number of specific recommendations that can be used to begin these critical conversations and a number of initial actions that specific stakeholders can undertake."

Action is required by multiple key stakeholders.

- Teachers
- Schools
- Districts

"The goal of *Catalyzing Change* is to create the synergies necessary to ensure that students' high school mathematics education provides them with the enduring understanding and skills, motivation, reasoning abilities, and mathematical enjoyment that each and every student deserves and must have to become a fully engaged member of democratic society, capable of achieving his or her full personal or professional aspirations.



Catalyzing Change in High School Mathematics: Initiating Critical Conversations. The National Council of Teachers of Mathematics, Inc., 2018.





ORGANIZING H.S. MATH

- Approach the mathematics in a structurally balanced way that includes
- attention to conceptual understanding, procedural fluency, problem solving, and mathematical reasoning and critical thinking processes

CATALYZING CHANGE

- Policy Makers
- Post-secondary Educators
- NCTM

REFERENCES: