

Fighting Fire with STEM

Fire Tactics

Objectives

The students will:

- Interpret the meaning of words and phrases as they are used in a text
- Write an opinion supported by factual information from text
- Write a sequential series of events based on evidence
- Explore different problem solving techniques
- Explore strategical thinking process
- Explore unit conversions
- Use metric system
- Find specific locations by using a map similar to a coordinate plane
- Predict possible outcomes from observations and information analysis

Standards

4-PS3-1	MP 4	RI.5.7	W.4.9	SEP3	SEP 5
4-PS3-2	MP 5	RI.4.1	SEP 2	W.5.7	SEP 4
5.MD.C.4	MP 6	RI.4.3	W.4.7	SEP1	SEP 8
MP 2	RI.5.1	W.4.8			

Background

Many individuals picture in their minds a police officer planning how to catch the bank robbers, or to rescue hostages from a dangerous situation when they hear the word “tactics”. However, this is not the only usage of the concept of tactics. A tactical approach means that there is a well thought out and organized plan in order for the outcome goal to be reached. For firefighters fire tactics are essential because their lives depend on it. It is not the same to fight a fire during the fall at 70° F versus fighting fire during the summer at 120° F, or a ranch house model versus a three-story apartment building. Side note: If the fire is taking place during a holiday, there is a chance that some or most of the volunteer firefighters may not be available. Fire tactics starts at the beginning of the day because firefighters must be well organized and dependable to one another. If one of the firefighters is sick or having a bad day or a family member is sick this firefighter is not reliable for the rest of the group. Every firefighter must be mentally prepared to

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put aside any personal problems and focus 100% on the task on hand. However, they are humans and it is difficult to ignore personal problems, therefore, the chief commander officer must know at the beginning of the day of any mental, emotional and physical aspect of every firefighter in the station, in case an emergency appears.

A firefighter must be able to analyze information either verbal, written, or visual in order to make a decision. Information interpretation is a key survival skill firefighters must master. The difference between interpretation and perception is that interpretation is the analysis of knowledge about an event before deriving a decision and perception is the usage of senses in order to derive a decision. Definitely, interpretation as well as perception are useful tools for firefighters to utilize before making a decision.

One of the main aspects of fire tactics is the term “sizing-up”, which, refers to a constant progression of information evolving as the event takes place and the firefighter analyzes and organizes the information as it comes available. Some aspects of the sizing-up concept include: gathering and comparing information from all sources such as before the 911 call, while arriving to the emergency, and the inspection on site to make sure the tactical plan is well organized. Next, the firefighter must perform a 360, meaning that the whole perimeter must be taken in consideration to prevent potential danger. Then, identify issues and secure relevant information from the subject matter expert (SME’s). The subject matter expert is anyone with any additional information about the situation. For example, in a house fire if the family is not on site the (SME) could be a neighbor who could provide vital information to the firefighters such as; where the bedrooms are located or the staircase’s location or how many people live in there or if there is a basement, information that the firefighters can include in the tactical plan. Identification of relationships is next, this means to be able to interpret and relate given information to the actual emergency. For example, in a commercial fire if you see five cars in the parking lot this means that it could be at least five people inside the building, or if there is a playground attached to the building this could tell us that there might be children in there. Always pay attention to details and relate those details to the emergency situation so you have the best tactical plan as possible.

Lastly, prioritize critical factors, it refers to the incident’s priority which are life priorities (main goal is to save lives), incident stabilization, and property conservation. Also, always count on non-constant variables. For example, if a fire hydrant located right next to the fire location is not working properly or not working at all it will cause a change in plans because now time and distance of the water supply will be different. Additionally, if there is traffic and the fire truck is not able to move freely it will affect the response time. Even though, the fire truck is an emergency vehicle and it does not have to obey the speed limit, if there is traffic on the way it will not be able to move as fast as possible.

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Inquiry Overview

Students will explore information interpretation and analysis, as well as a constant progression of information evolving as the event takes place. Students will be exposed to different decision-making processes according to given information (“sizing-up” concept). Additionally, students will utilize strategically thinking methods to place hydrants on a city map. Then, students will find the time needed for the fire truck to travel to the emergency location by using given speed and distance values. Lastly, students will have the opportunity to create a rescue plan based on information provided throughout the activities.

Suggested Inquiry Approach

Students will be presented key information for them to breakdown, analyze it and rewrite it in an organized and prioritized way for the information to be available in future emergency events.

Activity One *Shift Report.*

Work in Pairs

Estimated Time: 60 minutes

Introduction: 10 min.

Shift report reading: 5 min.

Shift report analysis: 25 min.

Shift report presentation: 10 min.

Debrief: 10 min.

Materials

Activity #1 for each pair of students:




 Student pages

Students will read the shift report as a class once before breaking it down to different pieces of information according to their importance and relevance. Ask students to read the shift report once again to make sure they understand the meaning of every piece of information provided by the shift report. Then, students will reorganize the information in a way for it to be available for future usage.

The shift report was written in an unorganized matter purposely for the students to think logically before deriving conclusions.

After all the students have had the opportunity to analyze the shift report ask them to share their analysis with the rest of the class. Advise students to provide positive feedback to one another in case information is missed in the transition between the shift report and its analysis.

Debrief

-  How did you and your partner organize the information from the shift report?
-  Have you written any formal reports at school? If so, what was the purpose?
-  Imagine your favorite TV commercial, can you summarize it into ten words or less?

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Suggested Inquiry Approach

Students will explore how to adapt their decision process according to progression of information provided by different sources. In addition, students will develop a strategic thought process to develop the most efficient hydro hydrants placement for their city.

Activity two Sizing-up H₂O Apparatus.

Work in Pairs

Estimated Time: 90 minutes

Introduction: 10 min.

City map observation: 15 min.





Hydro hydrants placement: 30 min.

Shift report presentation: 20 min.

Debrief: 15 min.

Materials

Activity #2 for each pair of students:

-  City map
-  Dry erase markers
-  Red dot stickers
-  Ruler

Students will start the activity by looking at city street maps either from their phones, tables, iPods, or computers. If students do have access to these devices just simply project some street maps from the internet for the whole class to observe. Ask the students to observe the images and share comments about them. Then, distribute the city map (one map per partner) and ask them to write down some observations about the map. Next, ask the students to look for missing elements on the map. Students might mention stoplights, stop signs, homes, businesses, cars, schools, churches, etc. If they do not mention hydrants it is OK because question number three on the student pages will ask them that. Ask students, why is it important to have the most efficient hydro hydrants locations and to know their location? Gather class information about hydro hydrants. Ask students for common knowledge about the hydro hydrants such as size, color, purpose, location around their community, what is around the hydro hydrants, how they work, etc.?





Now, students will have a project to do. They will decide the strategic placement location for 20 hydro hydrants on their city map. Each hydro hydrant will be represented by one red sticker dot. Advise the students to think about the advantages and disadvantages for each location. They should create a strategic plan before they place the sticker dots on the map.

NOTE: If the students want to use more than 20 sticker dots because they feel that 20 is not enough for their city, they need to write a claim to the teacher stating why they need more and how are they going to use them. After that, the teacher will provide more sticker dots (there will be a pack of 14 sheets of sticker dots and every sheet contains 60 sticker dots). There are plenty of sticker dots for the class.

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Allow plenty of time for all the students to finish their city map. After all the students had the opportunity to complete their city map, they will share their city maps with the class. If there is a way for the teacher to project their maps for the class to see it more clearly, great. If not, ask the students to hold the city map in front of the class. Students will explain their thought process and the reasoning for their hydro hydrant locations to the rest of the class. Remind the class that there is no right or wrong idea. The rest of the class will provide positive and constructive feedback to each group.

Debrief

-  What was the strategic procedure you used for the hydro hydrants placement?
-  What was the most challenging aspect of the activity?
-  Imagine that there is a budget issue and you just have enough money to place ten hydro hydrants only throughout the city. How would this affect your original strategic plan?
-  Assume that you have the ability to place one hydro hydrant on every corner of the city. What are the advantages and disadvantages of having one hydro hydrant on every corner?

Suggested Inquiry Approach

Students will explore how to calculate the traveling time from point A to point B based on the speed and the distance provided by a map. Moreover, they will utilize scales and proportions to transfer units from centimeters to miles as well as convert units from hours to minutes. In addition, students will develop the ability to adjust calculations based on unexpected events that will interfere with their current traveling calculations.

Activity three *Sizing-up Traffic Alert.*

Work in Pairs

Estimated Time: 90 minutes

Introduction: 10 min.

Tracing distance: 30 min.

Time calculation: 15 min.






Route presentation: 20 min.

Debrief: 15 min.

Students will start the activity by getting familiar with the term “Navigation System”, by asking them if they have any experience with google maps or if they have ever helped an adult to find a place using the navigation system app. In general, a navigation system is the part of the vehicle or a third party feature that provides location information to satellite signals and other companies that track location data from that

Materials

Activity #3 for each pair of students:

-  City map
-  Dry erase markers
-  Scissors
-  String
-  Ruler

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vehicle as well as other vehicles in the area. This way companies like Goggle maps, MapQuest, and Waze, just to mention some of them, acquire information from the satellite signals by the GPS systems (Global Positioning System) and federal agencies who provide information about constructions in progress or future detours due to future constructions. Lastly, some of these companies have access to the emergency radio channels providing information about car accidents or emergency events in the area.

Everything starts when on your smart phone you have selected “Location Services”, and enabled it. Then, the navigation system app will send real-time data back to the search engine provider more likely google. Later on, when google has the location information it compares this information to other user’s location information systems and it calculates how many cars are in the area and most importantly how fast they are moving. In reality the more people use the app and share location’s information, the more accurate the traffic data will be. When this location information is combined with monitoring of local departments of transportation and historical traffic patterns it creates a prediction of what traffic will be at a specific time and location.

During this part of the curriculum we will focus how traffic alerts affect traveling time. We will focus on the formula **Time = Distance/Speed**.

The distance will be measured by the students, the speed will be provided by the teacher and the student will calculate the traveling time from point A to point B.

First, students will be working in groups of two using the same city map from the previous activity with the hydro hydrants. Then, students will locate the fire station on their city maps. Next, the teacher will provide a 911 call informing students where the emergency location is:

4758N Sumplus St. between IMSA Ct. and Fusion St.

Remind the students the procedure of the activity.

1. Teacher will provide a long piece of string (1 meter long) to each partner in the group.
2. Students will trace the route (using the string over the map) they must follow to arrive to the emergency location as they were driving.
3. Students can NOT drive over any parks (green color shapes) or any infrastructure (grey colored shapes).
4. After the route is traced, measure the string in centimeters by using the ruler.
5. The unit conversion will be $1\text{cm} = \frac{1}{4}\text{mile}$.
6. Use the table provided in the student pages to calculate the traveling time it will take you and your partner to arrive to the emergency location.
7. Follow the data table and provide the time in minutes the fire truck will take to get to the emergency location.
8. You must find the most efficient route.
9. You must do one route at a time.

The teacher will provide a few traffic alerts impacting the student’s traveling routes. Here are some traffic alerts:

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1. Sullivan Park St. will be closed from Jameson St. to Galaxy St. due to construction.
2. Impala Ct. will be a ONE-way traffic going east due to the bridge construction on Chicago Ave.
3. Chicago Ave. will be a ONE way traffic going west due to the bridge construction and it will have heavy traffic (10 miles per hour) for the next three months.
4. There is an accident on PFS Ct. It will be closed from Torke St. to Acre St.
5. There is an overflowing on 95th Ave., due to a water pipe breakage.
6. There is a chemical substance spill on School St. It will be closed from Soso St. to College St.
7. The STEM school's parade started late this morning, Curriculum St. will be closed from Soso St. and College St. today.
8. All the cars from the dealership on Sumplus St. were moved to Peter Jones Ave., there is no access to Peter Jones Ave. from Sumplus St. to Main St.
9. Socat Ave. is very slippery and traffic is not moving.
10. Fusion St. is a one way street going east due to the governor's visit this week.

Allow the students some time to plan their route and start tracing it with the string then provide the first traffic alert. Then, after a few minutes, provide the second traffic alert, so on until you run out of traffic alerts. **Feel free to add more traffic alerts of your own.**

Remind the students that not because they were able to calculate the most efficient route that means that they are there yet. If a traffic alert is on the way, they must re-route their traveling route because they will be on the road still.

NOTE: There is a piece of information in the shift report that students might use if they pay attention to it. The shift report mentioned that the walking trail is wider now, enough to fit a truck. Let them figure it out. However, if a student asks about the walking trail attached to the Storm Circle, tell them that there is a marathon going on that day, but the one on 95th is available. On the other hand, if nobody asks then do not mention it.

The teacher will provide the speed. All the avenues will be 35 miles per hour and the streets will be 25 miles per hour. Feel free to change the speed at any given time or area based on the students engagement. Explain to the students that emergency vehicles have the right of way and that stoplights change color for them to go through. However, if the traffic is bad the cars have no place for them to move, so the emergency vehicle will be stuck doing 20 miles per hour instead of 45 miles per hour with no traffic.

Students must understand that this is not a competition it is a team effort to get to the emergency location to help people. This means that if they have crucial information about something it has to be shared with the other groups for the other groups to join them and together take care of the emergency.

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Debrief

- 🔊 What is the purpose of the siren on any emergency vehicle?
- 🔊 What implementation would you do to emergency vehicles to help them avoid traffic in order for them to travel faster?
- 🔊 Imagine that you are the city mayor of your town. How would you help the emergency vehicles or agencies, for them to avoid local traffic?