APPLICATION ID #1822 (Grade Band K-2)

Step 1: Learn

TASK

What issue are you and your students going to address (e.g., topics to consider include transportation, material resources, green space and energy use) and why? Discuss any data collected that demonstrates this topic is an issue. The topic you choose should impact your classroom or school.

Limit your response to 250 words.

TEAM RESPONSE:

Zero Miles Per Gallon

One of the biggest and certainly most vexsome environmental problems at our school, Concord Hill School, is the traffic in the parking lot during Friday dismissal. On Friday, all grades are dismissed at the same time. This causes a traffic jam when up to 84 families descend on the school's small parking lot to pick up the 100 students.

All the cars in the lot have their engines running generating pollution and wasting gasoline as they wait to pick up their children. A car that is idling gets zero miles per gallon, yet still produces 20 pounds of carbon dioxide for every gallon of gas they burn. Carbon dioxide is the principle gas linked to climate change.

The Second Grade Science Club (SGSC) calculated that on a typical Friday all the cars idling in the parking lot burn about six gallons of gas. In addition to the pollution generated by the idling cars, the traffic jam is a major source of frustration for teachers, parents and neighbors. Some cars were idling for more than 10 minutes in the lot. Despite the school's efforts, drivers would sometimes block the street when the lot was full causing frustration for neighbors who were driving down the street.

We were able to reduce the amount of pollution, carbon dioxide and wasted gasoline by 70% as well as stop cars from overflowing the parking lot. Our project was a success for parents, teachers, neighbors and especially the Science Club.

CITATION:

One gallon of gas burned per hour of idling is from the California Energy Commission's Consumer Energy Center website. (http://www.consumerenergycenter.org/myths/idling.html)

Zero miles per gallon idling: U.S. Dept. of Energy's FuelEconomy.gov website (http://fueleconomy.gov/feg/driveHabits.shtml)

20 pounds of carbon dixoide produced for each gallon of gas burned: U.S. Dept. of Energy's FuelEconomy.gov website (http://www.fueleconomy.gov/feg/co2.shtml)

Carbon dioxide principle gas linked to climate change: U.S. Energy Administration website. (http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html)

Step 2: Plan

TASK

How will your class address this issue? Include an overview of your plan, a description of the data that will be collected, and a prediction about how your class plan will impact the issue.

Limit your response to 800 words.

TEAM RESPONSE:

The first task of the SGSC was to identify the tools to help us understand and analyze our problem. We turned to Queuing Theory. Queuing Theory provides a way to analyze queues or lines with the goal of making them move faster and more efficiently. The cars moving through our parking lot are an example of a queue.

Queuing Theory has a number of real-world uses that touches all of our lives. We looked at checkout lines in grocery stores and the

post office; we studied the difference between lines at McDonald's (multiple lines) and Wendy's (single line) restaurants in our project. Fast-food restaurants were an example about which all the children could draw from their own experience. This enabled the Science Club members to make real-world connections between what they were learning in their project and their own life experiences. We applied what we learned about Queuing Theory to the traffic jam in our parking lot.

Our next step was to understand our problem and gather data about traffic in our parking lot. We measured using stop watches how long it takes for a car to move through the parking lot. We graphed our data so that the students could understand how the cars moved through the parking lot. The children observed that the cars that arrived closer to dismissal time idled in the lot the longest. The cars that arrived later went through the line much more quickly.

We found that on a typical Friday there are more than 50 cars and each car waited about 7 ½ minutes in the parking lot. That is like one car idling for almost 6 hours. We learned that an idling car burns one gallon of gas per hour. On Friday, our pickup line was burning 6 gallons of gas and producing 120 pounds of carbon dioxide.

We also interviewed teachers to get their ideas on how to improve the pickup process. The biggest complaint heard from the teachers is that they could not always hear the name of the student whose car had arrived because of problems with the walkie-talkies. As a result of these problems, students were often slow in coming to the parking lot to meet their car. The Science Club students wrote all this information down in log books so that they would have a record of the data.

The Science Club did a number of simulations of lines so that they would understand how to make lines move faster. We simulated the pickup queue in our parking lot by drawing the lot on a sheet of paper and then using pennies to represent the cars. When a car arrived at the lot the students would add a penny to the parking lot to represent a car arriving. When a car left, they removed a penny from the lot. This enabled the kids to work in small teams and experiment with different ways of solving the problem.

We found through our simulations that you can make the car pool line move faster by:

1) Increasing the number of teachers loading students into cars,

2) Loading students into cars faster;

3) Reducing the number of cars coming to the school through play dates and carpooling;

4) Staggering the time when cars arrive at the school.

We used all four of the ideas listed above in devising our solution. Specifically, the Club decided to ask our families to come pick up their children according to assigned times linked to the child's last name. We divided the alphabet into four groupings and requested that each group should arrive five minutes later than the group before them in the alphabet. This staggered the arrival of the cars. Our solution provided two advantages. First, the teachers would know which children to send to the parking lot at what time. This change by-passed the need for the walkie-talkies. Also, the children would be waiting for the cars, instead of having the cars waiting for the children. Second, the staggered arrival spread out when the cars arrived so that all the cars didn't arrive at the same time. This would put fewer cars into the queue at any one time, which should help avoid bottlenecks.

The data we were going to collect would be the time each car spent from entering our parking lot until they left the parking lot. We predicted that our plan would result in shorter car idling times than we originally had observed in our parking lot. We predicted less pollution would be created if the families complied with the staggered arrival times.

CITATION:

From the Wikipedia article on Queueing Theory: Queueing theory is generally considered a branch of operations research because the results are often used when making business decisions about the resources needed to provide service. It is applicable in a wide variety of situations that may be encountered in business, commerce, industry, healthcare,[5] public service and engineering. Applications are frequently encountered in customer service situations as well as transport and telecommunication. Queueing theory is directly applicable to intelligent transportation systems, call centers, PABXs, networks, telecommunications, server queueing, mainframe computer of telecommunications terminals, advanced telecommunications systems, and traffic flow.

Full Wikipedia article on Queueing Theory: http://www.wecanchange.com/dash/application/index.cfm?TEAM_GUID=30e90838-d7a4-40d7-b57c-17d4ba97a7c6#/step-2

Step 3: Act

TASK

What did your class do? How did you work with your class to create and implement your plan? Be sure to describe what data was collected and if the data reflected the predicted change.

Limit your response to 450 words.

TEAM RESPONSE:

After lots of research and simulations, the Science Club was ready to unveil its solution. We suggested dramatically changing the pickup procedure by assigning each family a time to arrive at the school. Previously, families could arrive at any time after 12:10 p.m.

To test our solutions, the **SGSC** explained the problem and our proposed solution to Mrs. Gershowitz, the head of our school. Mrs. Gershowitz gave us permission to run two special pickup days during which families would be assigned a time slot to arrive at the school for pickup.

Now we had to find a way to let all the families know about our project and get them to cooperate with our test. We used the "Thursday Messages" which is the weekly email sent to all families to tell them about our Science Club, our project, and to ask them to cooperate on the special pickup days. Also, each member of the Science Club created a piece of art that was put onto a flyer. The Science Kids took the fliers to each classroom to put them into all students' backpacks to tell parents about the staggered pickup. Some teachers asked the science kids to explain the Science Club project to their students when the science kids went to their classrooms to distribute the fliers.

The Science Club also made a short video promoting the project and the solution. The students wrote scripts for the video to tell our families about our project, the pollution that the cars make and how we proposed solving the problem. The video was posted on the web to inform families of the science club's activities and will be shown again at an all-school meeting on Earth Day.

The Science Club children collected two types of data to test our solution. First, they collected the time data, as before, that informs us as to how long each car spends idling in the lot. Second, we asked the names of the families as they picked up their children so that we could assess compliance.

The results were overwhelming positive. First, compliance was almost 97%. Second and most importantly, the idling time dropped from an average of over 7 minutes per car to 2 minutes per car. Our understanding of queuing theory had, in fact, lead us to a practical and effective solution to our problem.

(Samples of the artwork and one of the flyers are in a PDF file attached to this application. The video is also attached.)

CITATION:

Step 4: Reflect and Extend

TASK

What did your class learn? Explain how challenges were addressed, how what has been put into place will be sustained, and how others could replicate your work.

Limit your response to 650 words.

TEAM RESPONSE:

Our project was a huge success! The school is moving quickly to implement the Science Club's solution.

We were able to compare two very similar days based on the number of cars that came for pickup. On January 21, one of our observation days, we recorded 38 cars coming to the school for pickup under the old system. On the day of our big test, we recorded 38 cars coming to the school. The difference in these two days, even though the number of cars is the same, is very dramatic. Here are some highlights of our project:

1) Cars spent 70% less time idling in the parking lot on March 11 vs. January 21.

2) Several cars were in the parking lot for less than 60 seconds on March 11. On a typical Friday, cars idle in the parking lot for 7 1/2 minutes.

3) The longest any cars spent idling in the parking lot on March 11 was 5.25 minutes. On a typical Friday, the average car would idle for 7.5 minutes. On January 21, one car spent more than 10 minutes idling in the parking lot.

4) We had almost 100% compliance by families arriving during their assigned time slot. Only one family came early.

(A chart is attached in the PDF file submitted with this application showing the time cars spent idling before and after our solution.)

Mrs. Gershowitz, the head of the school, has decided, based on our project, that the school's carpool procedures will be changed to implement the **SGSC's** solution of staggered arrival times. All families will be assigned a specific time to arrive at the school for pickup. Everyone was so pleased with the solution, that the school wants to stagger pick-up arrival times not only on Fridays, but every day of the week.

Our carpool line on a typical Friday will go from burning 6 gallons of gasoline to burning less than 2 gallons of gas. Multiplied over many weeks, months and years this will make a big difference. Also, our solution makes us better neighbors to the families that live near the school since cars will no longer be blocking the street during pickup.

We now know that we can take small steps that will fix a problem that has been around for a long time. We also know that working as a team can be fun and working as a team is a good way to solve a difficult problem. We learned that even if you have the right solution, you still have to convince people to change for the solution to work. We used emails, backpack fliers and our video to convince families of the problem at our school and to get them to change. We also know that people everywhere fixing small problems can make a big difference.

Others can replicate our work simply by including children in the problem-solving phase of a school-wide problem. The children are not constrained by considerations of what is feasible or even reasonable and generated all sorts of ideas to address this small, but chronically annoying problem. Moreover, we learned that having children participate in simulations is a very effective teaching tool for young children. Participatory simulations both made complex ideas comprehensible for the children and made the learning very memorable. The children often referred to an idea that they wanted to use by saying “Remember when we were the cars trying to gather the pennies we needed before we could move....”

The Science Club was the first science club at our school. The kids, the parent mentor/club leader and the faculty advisor would like to do it again. The Second Grade Science Club is proud to be known as the group that solved the pollution problem in the parking lot at Concord Hill School.

(A thank you note from one of the students to the club's mentor is attached in our PDF.)

CITATION:

Step 5: Teacher Sharing

TASK

How did it go? Were you able to effectively support your students' efforts to make a sustainable change that benefits the environment? Why or why not? Would you and your class have done anything differently if given the opportunity?

Limit your response to 400 words.

TEAM RESPONSE:

The Concord Hill School is just kicking off a green initiative to focus on making the school more environmentally friendly. The "We Can Change the World" project gives a big boost to that effort by providing a huge success story that touches every family at the school. Further, it demonstrates that we can involve students, teachers and parents in identifying problems and developing solutions that work for the environment, our neighbors and our school.

Because Concord Hill is a small school, the idea of lots of schools around the country tackling small problems resonated with our school. Even though we fielded a team of just 13 kids, they were able to tackle a big problem.

In the future, we will promote the Science Club and the project much earlier in the school year. Some of our second graders were not able to participate because they had already made other after-school commitments.

We will look for ways to better integrate the program into the school's curriculum. This might include drawing in some of the "special" teachers who work with the kids on art projects or computers. The project did dovetail with the classroom work. The Science Kids were asked to write a script for their part in the video publicizing their project. This required research, note taking and writing which built upon the in-class report that the kids wrote on Arctic animals using the same steps.

Parent and teacher volunteers were essential to this project. They helped coordinate and monitor the Science Kids when they were observing pickup in the parking lot to ensure nobody wandered into traffic. The parents helped facilitate the in-classroom activities such as simulating how lines move. In this case, the parents and teachers were bean counters and each student had to wait in a line to get beans. We were able to demonstrate that lines can move faster if you add more bean counters or make the bean counters count faster.

We believe that the reason so many families complied with the request to come at staggered times on March 11 for the big test, was because the project was very visible at the school. The Science Kids wore special t-shirts, an email was sent to all families, backpack fliers went home with all students. There was a lot of support from the faculty, the administrators, the parents and the students for this project.

CITATION:

From Concord Hill Mission Statement:

Concord Hill School, a coeducational school for children in preschool through third grade, emphasizes both the academic and the developmental growth of the young child. We strongly believe in educating the whole child by promoting intellectual, social, emotional, physical and character development.

Step 6: Attachments

TASK

- You may include attachments to provide more information.
  - Up to 5 images (.jpg, .gif, or .png) or pdf or ppt
    - Concord Hill School Attachments2.pdf
  - 1 video - 1 minute or less (Videos will be reviewed for content, not the aesthetic quality of the video (.wmv, .mov, .flv)
    - CHS Report 03-14.flv