An Investigative Approach to Problem Solving Using Math Literature

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INTRODUCTION

This unit titled "An Investigative Approach to Problem Solving Using Math Literature" is a unit that provides the opportunity for students to explore the concept of problem solving through an investigative approach while using math literature as a springboard to captivate the student's interest as well as provide the understanding of the concept that is about to be explored.

Presently, I teach and work with the intermediate grade levels and teachers in the area of mathematics in one of the schools in the Houston Independent School District. My school is located in the West Region, specifically in the Westbury Feeder Pattern. Tinsley Elementary School is seven years old and surrounded by apartment buildings. The current population of the school is about 700 students. In terms of its demographics, the school is about 55% Hispanic, 41% African American, and 4% other. As stated above, most of the students live within walking distance to the school in the neighboring community. Because of the school's location, it has been observed that the attendance rate fluctuates during certain periods of the school year. As such this unit provides a very tangible opportunity for students themselves to start formulating questions and collecting data on the daily attendance rate for further investigation.

This opportunity will enable students to learn firsthand about their own personal and collective data. As this seminar focuses on "Real World Problems," students are given the opportunity to truly investigate a real-life situation. Secondly, the opportunity for students to realize that problem solving goes beyond mere arithmetic becomes more evident when students begin to compare the raw data and give reasons to justify why the information is the way it is. As students begin to also compare various data sets and represent them in many different ways, students will begin to build greater understanding between various kinds of data, such as numerical data.

As we look at our society and world today, statistics plays a major role in our everyday living, and as such this unit will enable students to become lifelong problem solvers through active hands-on explorations. Our students will be able to engage in in-depth mathematical discussions on how to represent their information, reflect and think critically about the factors affecting the data, and come up with an appropriate analysis as to why.

As this unit develops, the investigations and explorations are geared toward 4th grade students. However, the unit can be modified to meet the needs of students in 3rd or 5th grade and even the primary grades. The duration for which this unit is proposed for implementation is about six weeks, so as to fully have the opportunity to engage students in activities that will promote depth and complexity in their learning. The area of data analysis that this unit will address, such as collecting, organizing, graphing, and interpreting data, provides a feasible, engaging context in which students can excel in doing real-life mathematics. As students analyze data, they search for patterns and attempt to understand what those patterns tell them about the data represented.

OBJECTIVES

The objectives for this unit include concepts within the TEKS that are essential to having a

thorough understanding of objective 5, mainly the area of statistics.

The student will demonstrate an understanding of statistics.

(4.13)

(A) The student solves problems by collecting, organizing, displaying and interpreting sets of data.
(B) Interpret bar graphs:
- Formulate questions that could be answered from the representations
- Create different graphical representations that reflect various sets of data.

Objective 6 "incorporates the processes and mathematical tools with the TEKS that are used to find mathematical solutions to real-world problems."

(4.14)

The student applies mathematics that is used to solve problems connected to everyday experiences and activities in and outside of school.

(A) Identify the mathematics in everyday situations.
(B) Solve problems that incorporate understanding the problem, making a plan carrying out the plan, and evaluating the solution for reasonableness.

(4.15)

(A) Students communicate mathematics using informal language.
(B) Relate informal language to mathematical language and symbols.

RATIONALE

This unit is designed with the intention of investigating a specific aspect of problem solving called "Statistics" which will involve students in collecting and analyzing data. The reason for the approach to this area of problem solving is that the results from the Texas Assessment of Knowledge and Skills Test have shown an increasing decline in performance with regard to Problem Solving. Results indicate that students have difficulty processing information (data), especially when represented in graphical form. One of the toughest aspects for our students to complete occurs when asked to draw conclusions based on the data given. This aspect of the process is still a challenge to our students. Therefore, this unit will be a tool that would be implemented to help students develop a deeper understanding of how to analyze, collect, and interpret data. To do this, students will engage in daily collection and recording of attendance at my school over a period of four weeks.

The goal behind this approach is to enable students to use real-life data that is connected to their everyday life, thus making the mathematics more concrete for them to relate to and more realistic. I believe that engaging our students in mathematics that is totally part of their everyday life will spark interest and will hopefully open up avenues of learning and empowerment that will continue to foster their understanding of the process involved in collecting, interpreting and representing data. As our students engage in this investigative approach to learning, the language of mathematics will be used so as to increase vocabulary fluency.

There are several reasons why this curriculum unit is so important. One of the reasons for developing this unit is that the students at my school need a deeper understanding of Statistics. Objective 5 as a math strand covers Probability and Statistics. I feel that in terms of instructional delivery, there is that aspect of the concept that is not investigated thoroughly, thus students seem to lack the ability to look at data in more than one way. There is the need for students in my school to think more critically about data and have the ability to devise various ways of representing their findings. The collection, organization, representation, and interpretation of the

daily attendance of their fellow students will impact their lives greatly as students become more responsible and begin to articulate their findings.

As students engage in the process of working with data, they will notice that this aspect of mathematics is clearly different from other concepts in math. Students will notice that the interpretation of data varies from different sets of information, and as such, as they try to make sense of the data by representation and summarization, it will be evident to them that some of their findings may be disregarded based on how they would want to report or represent their findings.

This unit will enable me to develop in my students the understanding that data analysis goes beyond just the plotting of graphs and collecting of data. Students will have the opportunity to learn about the fundamental principles of statistics that would require them to develop questions about the data on attendance, so that they themselves can predict accurately the reasons why the results of their findings are the way they are.

The use of math literature in accompanying the implementation of the unit serves to bring about the integration of reading and mathematics. It enables the students to develop a more receptive attitude toward their learning and, in turn, provides a nurturing environment, which eliminates the fear of mathematics explorations and creates a venue for great experiences.

One of the areas of deficit that faces the group of students we teach at this level is the lack of mathematics vocabulary. With this unit, the incorporation of vocabulary as part of the formal language spoken within the classroom ("math talks") would impact students positively in that they themselves would begin to communicate freely using math terminology to express their thinking and reasoning. One of the component parts of this unit is to create an atmosphere for the students to drive their learning while the teacher's role would be that of a facilitator. As students work together in cooperative groups, special skills are developed. This is most important for students to develop at this time in order to be able to function successfully in society as they become productive citizens of a technological world. Through the interaction and investigative activities that students will encounter in this unit, there will be the opportunity to impact the lives of my students so that they become lifelong problem solvers.

UNIT BACKGROUND

As I observe the students at my school and work with them, I notice the need to teach them how to visualize ideas and concepts. This is one of the modalities that enhance their learning practices. Since this unit deals with collecting and analyzing data, they can readily relate to the data and make good sense of it because of its practicality and direct link to their own lives. As a result, I feel they will have a personal ownership of the outcome of this learning process. Being able to create a learning opportunity that also enhances other modalities, such as the kinesthetic, tactile, and auditory, promotes success in all learners, and no student will be left out. The learning environment will be nurturing enough to encourage those learners that are usually frustrated when it comes to the learning of mathematics.

When students can also learn by using their senses, the impact it leaves in their lives is eternal; students retain more. The ancient Chinese proverb states the following: "I hear and I forget. I see and I remember. I do and I understand." Further observation indicates that students learn better when the environment of learning includes fun. It is my hope that in using math literature books that break down the concept of data analysis, students will develop a more receptive appreciation for mathematics through reading. The incorporation of these books will foster rather than stifle the excitement of learning mathematics through literature connections.

There is the need to pay close attention to the inclusion of vocabulary that directly relates to mathematics in this unit. Since the state of Texas started administering the Texas Assessment of

Knowledge and Skills Test, the level of rigor of the test has continued to increase. One area of increased rigor is in the way the questions are stated. Students must have an understanding of the language of mathematics which entails mathematics vocabulary in order to excel on the test. Therefore, having a firm grip on the terminologies that this unit will incorporate is crucial and will also benefit the students I teach. Both teacher and student will have an understanding of what the other is saying.

When students can express their thinking orally or in written form by using appropriate language and terminology, it provides true evidence of what a student understands. One of my goals through this unit is for students to become flexible in their mathematical thinking and have the ability to understand that a problem can be solved by using more than one math strategy. Students will be able to formulate questions that would be answered by the graphical representations and apply explicit descriptions concerning their responses. This, in turn, will bring about the integration needed between mathematics and writing.

In order to help students further their understanding of this area of mathematics, the Principles and Standards Document states, "The emphasis on working with data entails students' meeting new ideas and procedures as they progress through the grades rather than revisiting the same activities and topics" (NCTM 2000, 48).

Delving into this unit that focuses on Data Analysis, I strongly believe, will enable me to see my students not only as data analysts, but will allow me to groom them holistically as problem solvers that are mathematically empowered. In the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* (1989), Ruth Parker of the Mathematics Education Collaborative described that mathematically powerful students have these traits:

- Understand the power of mathematics as a tool for making sense of situations, information, and events in their world
- Are persistent in their search for solutions to complex, messy or ill-defined tasks
- Enjoy doing mathematics and find the pursuit of solutions to complex problems both challenging and engaging
- Understand mathematics is not just arithmetic
- Make connections within and among mathematical ideas and domains
- Have a disposition to search for patterns and relationships
- Make conjectures and investigate them
- Have "number sense" and are able to make sense of numerical information
- Use algorithmic thinking and are able to estimate and mentally compute
- Work both independently and collaboratively as problem posers and problem solvers
- Communicate and justify their thinking and ideas both orally and in writing
- Use available tools to solve problems and to examine mathematical ideas

A major goal of mathematics instruction is to help students develop the belief that they have control over their own success or failure. This autonomy will develop as students gain confidence in their ability to reason and justify their thinking. It grows as students learn that mathematics makes sense, is logical and is enjoyable (NCTM 1989, 29).

The Instructional delivery of this unit will focus on four major areas:

The content of the unit will explore in depth the process involved in Data Analysis. For students to fully grasp and have a thorough understanding of this strand of mathematics, students will engage in hands-on explorations as indicated in Lesson Plan 2 of the unit. Students will gather their daily attendance for a period of four weeks. During these weeks students will work in cooperative learning groups. One group will be working on formulating questions that the data

seems to portray. Another group will be piecing together the data collected and trying to make reflective predictions as to what the data is revealing. This investigative approach to learning will be the format of the instructional delivery of the unit.

The second part of the Instructional delivery would be the integration of writing into the process of learning. Marilyn Burns points out that "a careful examination of her students' writing reveals whether or not they understand." She believes that writing should be "an integral part of student learning" (1). William Zinsser states it clearly: "Writing is a way to work yourself into a subject and make it your own" (Cited in Burns x, 1). As part of the 4th Grade Texas Essential Knowledge and Skills, all students are assessed in writing. This curriculum unit enables students to communicate through writing the various forms of questions that are formulated to aid in the collection of data. Secondly, students will be required to write about the interpretation and analysis of the data that was collected. Students will be using their math journals to record their daily reflections concerning each lesson. The journal entries will serve as a means of communication between student and teacher.

Writing is now an integral part of all subjects, and as a result, this unit will provide the opportunities for students to demonstrate their understanding of the concepts that they are being taught. As indicated in the Lesson Plans, students will summarize a lot of their mathematical thinking through journal writing. As the students write and justify their ideas about the math being used, teachers are provided with an insight into the students' thinking, especially when students can formulate questions, collect data, organize that data, represent it, analyze, and communicate their ideas so that there is reasonableness in what is communicated.

The NCTM (2000) standards indicate the importance of writing in mathematics as follows:

> Writing is a communication skill that has been used too infrequently in mathematics. (28) …writing about mathematics, such as describing how a problem was solved also helps students clarify their thinking and develop deeper understanding. (26)

The inclusion of writing in this curriculum unit serves another purpose – that of assessment. Students are required to engage in writing that assesses their knowledge in three ways. By reading students responses to questions, the teacher has an insight as to how well the instructional goals of the unit are being met. The homework assignments in the unit provide a means of checking on the progress of each student. Secondly the writing assessments enable the teacher to gain access into each student's personal progress. Thirdly, the writing piece provides an opportunity to communicate to parents the progress of their children.

The incorporation of mathematics vocabulary is another part of this unit. As we know, mathematics has its own language; therefore, if mathematics vocabulary is routinely connected to daily instruction, students will develop that language fluency in their daily communication of mathematical ideas. In this unit, students will be given the opportunities to brainstorm (in groups) mathematical words that relate to the concept of the unit. The use of this approach forces students to search for vocabulary that will become an integral part of their oral and written communication. Students will be expected to use the appropriate vocabulary and language as they share their findings. As we look at Lesson Plan One of the unit, this activity becomes the bedrock of the unit and supports the fact that mathematics has its own language. Words such as data, frequency, analysis, graphs, bar graphs, horizontal, vertical, line plots, axis X and Y, scales, and intervals will be part of the students' daily usage in communicating their mathematical ideas.

As indicated in Lesson Plan One, the brainstormed vocabulary words for the unit will be displayed on a bulletin board within the classroom to serve as a reference point for the students. The availability and visibility of these words will also create within the minds of the students a lasting image. The board will actively be used as students continue to add on to the list as they

find other words that relate to the unit. As Antisthenes (c.445 - c.365 B.C.) stated, "The investigation of the meaning of words is the beginning of education." This conceptual idea is what is reflected in this unit. Students in their reflective writing will incorporate these words, thereby creating that integration between vocabulary and writing. This point is supported by Rheta N. Rubenstein:

> Learning the words of mathematics need not be a burden. Words are a natural part of human activity; they have histories, relations to one another, and connections to the real world. Students can appreciate language and value its role in supporting communication and understanding when they are engaged in inventing, visualizing, and studying the history, uses and connection of words. (Cited in Murray 60)

As we continue to examine our annual (TAKS) Texas Assessment of Knowledge and Skills Test, we notice that vocabulary plays a major part in the ways the questions are worded. Therefore, the integration of vocabulary activities is crucial in this unit in that it helps to build deeper conceptual understanding.

The use of mathematics literature plays a key role in this curriculum unit in that it will provide the stimulation that is needed to make students think critically and provide a better understanding of the concepts that would be a part of their learning goals. The incorporation of math literature serves an important purpose because as a student, I found reading about a concept very interesting because it enabled me to visualize the mathematical ideas within the book in a non-threatening way. It served as a springboard so that there was a bridge of connection that was created between the reading and the mathematics. This is also an opportunity that I would like to create for the students I teach – a learning environment that integrates subjects, is non-threatening, very stimulating, actively engaging and nurturing. The math literature books used in this unit include the following:

> *The Best Vacation Ever* by Stuart J. Murphy; *Lemonade for Sale* by Stuart J. Murphy; *Discovering Graph Secrets* by Sandra Markle; *Bar Graphs* by Vijava Khristy Bodach; *Let's Graph* by Lisa Trumbauer; and *Graphs* by Bonnie Bader.

These books were chosen based on the criteria stated by the National Council of Teachers of English (NCTE) and International Reading Association (IRA) Standards for the English Language Arts. Based on these criteria, these books demonstrate "mathematical integrity." That means that the mathematical ideas and concepts are mathematically sound. The books have "potential for varied response"; the books are invitational rather than didactic.

The third aspect of the criteria is that they have "an aesthetic dimension." These books have a way of captivating the interest of the students, because of their pictorial, graphical, and representational qualities. The final criterion is the "ethnic, gender, and cultural inclusiveness." The content of the books is universally sound for any group of students regardless of their ethnic background. With these qualities in mind, the second lesson plan of the unit uses the book titled *The Best Vacation Ever* by Stuart J. Murphy to introduce the students to the process involved in collecting data, ways to record data, and examples of types of questions to ask when engaged in such an activity. It is very important for students to fully understand this process because they will also engage in the collection of daily attendance data of their classmates. The book then serves as an important and relevant springboard into the lesson activity for Lesson Plan Two.

The next books entitled *Lemonade for Sale* by Stuart J. Murphy and *Discovering Graph Secrets* by Sandra Markle will be used in Lesson Plan Three to help students visualize through the use of pictorial representations. These books are a valuable resource for students to refer to as they begin the process of representing their collected data in various forms. Students will be able to understand the different parts of a graph and how to label them accurately.

The rest of the books – *Bar Graphs* by Vijava Khristy Bodach, *Let's Graph* by Lisa Trumbauer, and *Graphs* by Bonnie Bader – are all reference books that students can consult to obtain vocabulary meanings or references to other types of graphical representations. As students work on group activities, these books will be at the disposal of the students to use as resources to support their findings. My role in these activities will be that of a facilitator, providing assistance where necessary.

In conclusion the unit background will address the concept areas associated with Data Analysis as defined by the *Principals and Standards for School Mathematics*:

> Students will formulate questions that can be addressed with data. They will collect, organize, and display relevant data to answer them. They will also select and use appropriate statistical methods to analyze data, develop and evaluate inferences, and make predictions that are based on data. Through the implementation of this unit, students will learn about how to recognize differences among data gathering techniques, including observation and experimentation; they will use formal investigations on how the questions they seek to answer helps determine what data gathering approaches are appropriate.

In the Lesson Plans, the teaching strategies that the unit addresses are hands-on explorations due to the nature of the type of problem-solving experiences in which the students will be engaged.

Students will be required to engage in cooperative learning groups, so as to foster the development of "math talks." Students will be required to discuss their findings as they delve into the various activities for this unit. As students work together to solve problems and engage in the appropriate discussions, there is the tendency for them to empower each other as they learn from each other. Oral presentations would be another way to involve students in sharing their findings as they collaboratively work together. This strategy will enable students to practice their communication and public speaking skills.

Finally, the types of assignments incorporated into this unit will require students to collect and organize data in a graphical manner that is appropriate to the set of data; engage in reading math literature books that promote more understanding to the concept of Data Analysis; describe or summarize a set of data; and compare and contrast two or more sets of data and pose questions that reflect a topic and purpose that they have identified for a data investigation. To fully evaluate the success of this unit, students will demonstrate this by writing and using appropriate vocabulary to successfully communicate their personal learning outcomes that this unit has enabled them to accomplish. This unit involves a lot of investigations pertaining to the collection of data. As a result, students will be observing and recording the daily attendance rate of their class. To work with this type of problem involving data collection would require the collection of data to take about four weeks. The need for such a time frame is due to the validity of data that is needed to truly portray accurate predictions that will be drawn from the study of the collected data. Implementing this curriculum unit will take about six weeks so as to give students the opportunity to investigate and learn in depth the process involved in Data Analysis. After all, this curriculum unit has to do with investigations.

LESSON PLANS

Lesson Plan One (Introduction)

Students will engage in a brainstorming activity to elicit vocabulary words and statements that tie or relate to Data Analysis.

Objective: 4.15 A

Students will use a Web graphic organizer to organize brainstormed vocabulary words and

concepts that relate to data and communicate mathematical ideas using formal language.

Materials

12"x18" white construction paper for each group, a variety of colored markers, pencils, math journal notebooks

Procedures

1. For this activity, students will be seated in cooperative learning groups.
2. The following question will be posed, "What words or math ideas come to your mind when the word data or statistics is mentioned?"
3. Each cooperative learning group will be made up of 5 to 6 members. Each member   within the group will be assigned a responsibility such as: Recorder, Reporter, Materials Manager, Principal Investigator, Timer, and Clean-up Manager. Prior to activity each post is explained.
4. An allotment of 30 minutes will be given to brainstorm and organize as many words and phrases that relate to statistics using a Web graphic organizer.
5. As students work in groups, the teacher monitors each group's participation and provides any assistance where necessary.
6. After 30 minutes, there is a call back for a whole group debriefing session. During this period, each reporter for their group reports to the whole class.
7. As a summary, the teacher then creates a general web, highlighting the words and phrases that relate to the unit of investigation.
8. Students are given 10 minutes to copy in to their math journals the newly created "web" of data. This collection of vocabulary words would be used throughout the unit, with other additional words as necessary.
9. A bulletin board created for this unit will have the class generated words mounted,   to serve as a reference board.

Homework

As an extension of learning, students are required to find other words that relate to data.

Evaluation

Students are required to write a brief summary of what was learned.

Lesson Plan Two

The second lesson of the unit will focus on using math literature as an introduction to Collecting Data. The book to be read for this lesson is *The Best Vacation Ever* by Stuart J. Murphy.

Objectives: TEKS 4.13 A; 4.14 A/B

- Students will solve problems by collecting daily attendance data.
- Students will identify the mathematics in everyday situations as it relates to attendance.
- Students will be able to relate and understand how to collect data through a math literature approach.

Materials

Book: *The Best Vacation Ever* by Stuart Murphy, recording sheets for daily attendance record, math journal, notebooks, blank writing sheets

Procedures

1. The story *The Best Vacation Ever* by Stuart Murphy is read aloud to the students with the following purpose questions posted on the board for all students to see.
    a. What steps should you take when getting ready to collect data?

    b.   How did they keep track of the data?
    c.   How was the data collected represented?
    d.   In this story what conclusion can you draw from the data?
2. Students are given 20 minutes to discuss in their cooperative learning groups the questions on the board. The recorder for each group takes notes. The principal investigator for each group makes sure that all group members are participating.
3. The teacher engages the whole class in discussions pertaining to the posted questions. Must relate this activity to what students will participate in the next few weeks (20 minutes).
4. A chart outlining students' assignment for mathematics on Data Analysis is presented.

<div align="center">DATA ANALYSIS OUTLINE: AN INVESTIGATION</div>

a.   Daily attendance will be taken at 9:30 a.m. recorded as follows: Number of students present and absent out of total number of students in class.
b.   Choose a format that would best represent how to keep record of the daily attendance.
c.   How would you keep track of your data?
d.   What are you noticing about your data and what types of representations would you feel is the most appropriate to display your findings.

Homework

Students are to formulate three questions that could be answered from the data collected from the day's attendance.

Evaluation

Students are required to write a reflective paragraph about four things they learned in class today.

Lesson Plan Three

The third lesson in this unit focuses on types of representations that could be used to organize data

Objectives: TEK 4.13 A; 4.14 A; 4.15 B

- Students will solve problems by organizing and displaying data.
- Students will create different graphical representations.
- Students will relate informal language to mathematical language and symbols.

Materials

Books: *Lemonade for Sale* by Stuart J. Murphy; *Discovering Graph Secrets* by Sandra Markle; graph sheets; samples of 4 types of graphs – line graph; bar graph, pictograph, and circle graph; containers of color tiles; Internet Explorer

Procedures

1. Using the two books as resources and the Internet, students will engage in defining the following types of graphs in their cooperative learning group: graphs, line graphs, bar graphs, pictographs, and circle graphs.
2. Students would use the Venn Diagrams as a graphic organizer to compare and contrast between two types of graphs or use a table to indicate the characteristics of each type of graph the students are allowed to make their own choice).
3. Students work in groups to define the following terminologies: scale, horizontal axis, and vertical axis
4. Bring the class together for a whole group discussion on what their findings are. Engage students in mathematical discussions.
5. Model for students how to go about drawing a bar graph, labeling accurately the axis and

deciding on what scale to use.

6. Engage students in a hands-on-exploration using color tiles. Each group is asked to classify their container of color tiles by color, indicating the amount of each color.
7. Each group keeps a record of how many color tiles of each color there is.
8. As a class, they decide on what scale to us to create a Bar Graph. The teacher poses questions to students such as:

    a.   What type of Bar Graph would you use to represent this data Horizontal or Vertical (groups decide based on vote)?

    b.   What title would you give to this graph (each group decides and a general agreed upon title is used)?

    c.   What axis would be used to graph the amount of color tile per color, and what axis would be used to indicate the colors of each tile and why (as students engage in discussions, the teacher facilitates the discussions where necessary). Students can also use the math through literature books as resources to help them in their decision.

9. Each student is given a graph sheet. With the model on the board and their ideas in front of them, students are asked to create a Bar Graph using the data collected on color tiles. Each student solicits ideas or clarification from their team members where necessary.
10. As part of the closure to the lesson, students are asked the following questions pertaining to their graphs:

    a.   What can you say about the data represented on the graph?

    b.   Which color of tile is the greatest and least and by how much?

    c.   How would you figure out the quantity of yellow color tiles we have in the class?

    d.   What else can you share about what you see in the graph?

Homework/Assessment

Students complete the assignment as an extended homework assignment. This activity is also graded.

Lesson Plan Four (2-day 90 minute lesson)

From the data collected on attendance over a 4 week period, students will now be to organize their own class data, making decisions as to how to display it meaningfully.

Objectives: TEKS 4.13 A; 4.14 B; 4.15 A
- Students will be able to collect, organize, and display data.
- Students create different graphical representations that reflect various sets of data.
- Students will solve problems that incorporate understanding the problem, making a plan, carrying out the plan.
- Students communicate mathematics using informal language.

Materials

Books: *Bar Graphs* by Vijava Khristy Bodach; *Let's Graph* by Lisa Trumbauer; *Graphs* by Bonnie Bader, collected data on student attendance during four weeks, roll of graph paper, color markers, pencils and rulers, math journals

Procedures

1. The classroom is set up in cooperative learning groups (4 groups of 6 students)
2. The collected data on student attendance is passed out to each group (students have been collecting this data over a 4 week period every school day at 9:30 a.m.).
3. Each group is assigned a responsibility as follows:

    Blue Group: Organizing the attendance data in a sensible manner for all to understand.

Yellow Group: Making decisions on what would be the best graphical representation to use in displaying the data. Reasons for choice need to be stated.

Orange Group: Creating an action plan that incorporates the scale to use; preparing the graphical sheet for the plotting of the graph.

Green Group: Working on a class report that provides a summation of the outcomes of this learning process.

4. Students are required to use the books listed as resources, their math journals as references and each other.
5. The teacher monitors students' progress and acts as a facilitator. Provides assistance when needed.
6. Each group is required to give a presentation to the whole class on their part of the activity. The teacher grades each group based on the criteria below:

Evaluation/Assessment

Prior to each groups assigned activity, a grading criteria is discussed with students as follows:

Content: 30%
Communication: 25%
Organization: 25%
Teamwork (participation): 20%

Lesson Plan Five (Final Lesson)

The students will be able to see for themselves the end product of their study on the attendance rate of 4th grade students over a 4 week period.

Objectives: TEKS 4.13 A & B; 4.14 A & B; 4.15 A
- Students will interpret/solve problems by organizing and interpreting sets of data in bar graphs.
- Students will formulate questions that could be answered from the representations.
- Students will solve problems and evaluate the solution for reasonableness.
- Students will communicate mathematics using informal language.
- Students will identify the mathematics in everyday situations.

Materials: Collected data from five 4th Grade classes, graph paper, colored markers, pencils and rulers.

Procedures (time allotment: 2-day 90 minute block)
1. Each cooperative learning group is given the attendance recordings of a 4th Grade class (this lesson is an in-class math project).
2. Each cooperative learning group works together to problem solve by creating a bar graph that represents the data of each class's student attendance.
3. The same procedures taken in Lesson 4 applies also in this case (refer to lesson activity for lesson 4).
4. Students are provided with assistance where necessary as they work as teams to accomplish the stated objectives for the lesson.
5. Each group's end product is assessed by using a Rubric.

Evaluation/Assessment

Since this is a lesson that focuses on an end product for the unit, an Assessment Rubric with a rating scale of 1-4 is used, 1 being the lowest score and 4 being the highest score. The end product will be graded based on the following criteria on the rubric:

1. Clarity in data
2. Accuracy of data

3. Visual representation of data
4. Creativity in presentation
5. Follows guidelines for graph construction

Rubric

Assessment Rubric for a Bar Graph

Rating Scale: 1 2 3 4

1. The graph conveys the important and intended information (data) clearly.	Rating: _____
2. The graph conveys the important and intended information (data) accurately.	Rating: _____
3. The graph conveys the important and intended information (data) visually.	Rating: _____
4. The graph conveys the important and intended information (data) creatively.	Rating: _____
The graph conveys the important and intended information (data) correctly in terms of guidelines for graph construction.	Rating: _____

Comments by Students:

_____

_____

            Signed _____ Date _____

Comments by Teacher:

_____

_____

_____

Signed _____   Date_____

ANNOTATED BIBLIOGRAPHY

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    This book addresses ways to use bar graphs to represent data.

Burns, Marilyn. *Writing in Math Class*. Sausalito, CA: Math Solutions Publications, 2001.
    This is a resource book that provides examples of students writing of mathematical ideas and thorough
    explanations of student thinking.

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