DOCUMENT RESUME

ED 389 525 SE 056 805

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TITLE Authentic Assessment Strategies for Elementary Science & Mathematics: A Beginning.
INSTITUTION Science and Mathematics Network of Central Ohio.
SPONS AGENCY Battelle Memorial Inst., Columbus, Ohio.; Martha Holden Jennings Foundation, Cleveland, Ohio.; National Center for Science Teaching and Learning, Columbus, OH.; Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE 94
CONTRACT R117Q00062
NOTE 102p.
AVAILABLE FROM National Center for Science Teaching & Learning, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210; Science and Mathematics Network of Central Ohio, 445 King Avenue, Columbus, OH 43201.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Educational Assessment; Educational Change; Elementary Education; *Elementary School Mathematics; *Elementary School Science; Mathematics Instruction; *Partnerships in Education; *School Business Relationship; Science Activities
IDENTIFIERS *Authentic Assessment

ABSTRACT

An increasing number of schools and businesses are entering into more collaborative partnerships focusing on frequent classroom interactions centered around active learning. The "Authentic Assessment Project" was developed by the Science and Mathematics Network of Central Ohio to assist teachers and business partners in designing innovative student assessment to accompany these partner-assisted classroom activities. This document is a compilation of plans to assess student learning in science and mathematics that represent the type of authentic, performance-based assessment that is currently being advocated at the national level. The tasks presented in this document: relate directly to instructional goals identified as desired student outcomes; require students to apply what they have learned; have more than one correct answer or possible outcome; and involve more than one step to complete. Each assessment plan contains the following information: summary of the activity; learning outcomes; assessment information; scoring; issues and implications; impact; and references. (JRH)

AUTHENTIC ASSESSMENT STRATEGIES
for
ELEMENTARY SCIENCE & MATHEMATICS
A BEGINNING

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Compiled by the
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With funding and assistance from:

The Martha Holden Jennings Foundation

Battelle

National Center for Science Teaching & Learning

1994

This publication was supported by the National Center for Science Teaching and Learning under grant #R117Q00062 from the Office of Educational Research and Improvement, U.S. Department of Education, The Martha Holden Jennings Foundation, and Battelle. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the sponsoring agencies.

ACKNOWLEDGEMENTS

Compilation of this document by the Science & Mathematics Network of Central Ohio would not have been possible without the participation and assistance of numerous individuals, and the financial support of The Martha Holden Jennings Foundation, Battelle, and the National Center for Science Teaching & Learning (NCSTL) at The Ohio State University. The editors are extremely grateful for this help and support, and wish to acknowledge the contributions of each.

Sincere appreciation is extended to The Martha Holden Jennings Foundation for their commitment to authentic assessment as evidenced by their financial contributions to this project. Additionally, appreciation is extended to Battelle for their matching financial contributions as well as the use of their conference facilities for the inservice training sessions. At Battelle, special thanks are given to Barbara Sills, Director, Community and Education Relations for her continued support and commitment to this project. At the NCSTL, special thanks are given to Dr. Arthur L. White, Co-Director of NCSTL and Professor of Educational Studies, for providing a graduate course offering for teachers participating in this project, to Michael Aiello, NCSTL, Project Manager, for coordinating the printing of this document and its dissemination to target audiences, and to Dr. James Altschuld for his advice and direction.

Special appreciation is extended to each of the assessment consultants for their hard work and long hours spent researching the topics of alternative and authentic assessment, providing instruction on assessment methodologies, and assisting teachers and business partners in their development and review of assessment plans. Consultants to this project were Karen Boreman of Upper Arlington City Schools, Jeanette Cox of Gahanna City Schools, Tom Cullinan of Westerville City Schools, and Linda Miller of Columbus Public Schools.

At the Science & Mathematics Network, sincere gratitude is extended to Cathy Behrends, Assistant Director, and Linda Gardner, Program Assistant, for their invaluable help in managing and coordinating the day-to-day operations of this project and their work on this publication. Additionally, the assistance of Carol Matthews from American Electric Power was invaluable in the final editing stages.

CONTENTS

INTRODUCTION

An increasing number of schools and businesses are entering into more collaborative, partnerships focusing on frequent classroom interactions centered around active learning. Few teachers and even fewer business partners have the in-depth background to design innovative student assessment to accompany these partner-assisted classroom activities -- many of which are of an active and unique nature. For this reason, The Martha Holden Jennings Foundation chose to fund the "Authentic Assessment Project" developed by the Science & Mathematics Network of Central Ohio. Matching funds were contributed by Battelle.

The goals of this project were twofold. First, the project provided focused, in-depth training and assistance to 11 teams of elementary teachers and their business partners. The second goal was to assist partnerships in the development and implementation of plans to assess student learning in science and mathematics. It is these plans that comprise the contents of this document.

The plans represent the type of authentic, performance-based assessment that is currently being advocated at the national level (OERI, 1988). Authentic assessment and performance assessment are broad terms used to denote a variety of assessment techniques that require students to demonstrate competencies or knowledge through their creation of answers or products (Feuer & Fulton, 1993). Specific techniques involve observing students as they work, interviewing them about their work, as well as examining the final work product. This might include such methods or processes as observations, interviews, demonstrations, exhibitions, portfolios, long-term projects, and student self-assessments (Abruscato, 1993; Madaus & Kellaghan, 1993; Popham, 1993; Worthen, 1993).

In designing these plans, teachers and business partners began by identifying desired student outcomes. These were the "big ideas" (NCTM, 1993) such as "students will be able to organize and express in their own words important science ideas" or "generate a hypothesis and design an experiment to test that hypothesis." Next, they had to decide what purpose the assessment would serve, and considered such questions as "would the assessment outcome contribute to the student's grade," or "was this to be used by the student and teacher solely for reflection on the student's academic growth over time?" Then, specific assessment strategies were chosen and tasks (along with scoring criteria) were developed according to the following guidelines. Tasks were to:

- relate directly to instructional goals identified as desired student outcomes,
- require students to apply what they had learned,
- have more than one correct answer or possible outcome, and

- involve more than one step to complete.

Finally, teachers and business partners were encouraged to involve students in the development of these tasks, as well as the scoring criteria, and to be constantly aware of equity issues by making a conscious effort to ensure assessments were free from bias (i.e., cultural, ethnic, gender, etc.).

Following development and implementation, the assessment plans were evaluated through a variety of extended, multilevel review procedures. Initially, plans were reviewed and revised by the partners immediately following implementation. Next, plans were given to the assessment consultants who reviewed them for thoroughness and technical accuracy, and who worked collaboratively with partners in making additional changes. Finally, the plans underwent a "peer review" by other teachers in the project who evaluated materials on their useability and usefulness. Teachers considered such questions as: Was enough information given to carry out the activity? Was the information succinct and to the point? Was the activity appropriate for the grade or developmental level? Was the presentation of information such that specific information could be readily located?

Each assessment plan contains the following information.

- **Summary of the Activity:** brief overviews of the assessment activity and the partners' involvement

- **Learning Outcome(s):** desired student learning outcome(s) measured by the assessment

- **Assessment Information:** includes the assessment methods, purpose(s) of and use(s) for the assessment information, social structure of the activity, time needed for the assessment, materials for the assessment (and in some cases, materials for the preliminary activity), and instructions to the students

- **Scoring:** includes the scoring criteria, a brief discussion of how the criteria were developed (with particular emphasis on student involvement), and any concerns with regard to equity issues

- **Issues and Implications:** teachers noted issues of concern in either developing or implementing these assessment activities of which other teachers need to be aware and the implications of these concerns for instruction

- **Impact:** brief discussion of the effect of this assessment activity on the teacher, business partner, students, or others

- **References:** citations of copyrighted materials used or noted in the activity

It is important to note that authentic assessment activities are content and context specific. As such they should reflect and incorporate instructional methods as well as content. In other words, if it is important that students be able to create and design observation forms, then the assessment should require them to do just that -- create and design an observation form. With this in mind, the authors of this document offer this as illustrative of the process involved in the development of such activities. The specific plans and activities have not been tested, revised and retested sufficiently to be considered a polished final product. If the assessment instruments and/or criteria are appropriate for your particular instructional activities, then we encourage you to use or modify these plans accordingly. More importantly though, it is our hope that this document might inspire other teachers, along with their business partners, to begin undertaking development of their own authentic assessment activities.

Additional copies of this document can be obtained from:

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MONEY MADE MEANINGFUL

Topic:	Mathematics
Grade Level:	Grade Two
School:	Brookside Elementary, Worthington City Schools
Partner:	The Anderson's General Store

Summary of the Activity:

There are three major hands-on activities in this unit designed to help children recognize coins, understand values, add groups of coins and make change. These activities prepare the children to conduct a bake sale where they put into practice what has been learned in class.

The business partner and teacher worked collaboratively to develop, implement and assess the learning activities involved. Weekly planning of these activities and preparation of the materials were the responsibility of the classroom teachers. Business partners helped facilitate the activities and provided written and verbal feedback to the teachers each week. The written responses were in the form of anecdotal records and checklists.

The culminating project involved selling cookies made by The Anderson's General Store bakery. The business partners were utilized as advisors while the students sold the cookies and made the money transactions, giving help when necessary. Business partners provided teachers with verbal feedback regarding the students' ability to make the transactions.

Learning Outcomes:

Using manipulatives (and later real money) to understand money; specifically, recognizing coins and their relationships; understanding values; and adding groups of coins and making change.

Assessment Information:

Methods:	• Observations and review of student work
Purpose of Assessment:	• To review the development of student progress over time
Social Structure:	• Students work individually in the first two activities; • Students work in pairs in the last activity

Time:

- Activity One: 12 sessions of 45 minutes each.
- Activity Two: 2 sessions of 45-50 minutes each.
- Activity Three: 15 minutes (setup), 45 minutes (actual sale), 15 minutes (clean up), and 45 minutes (sort and count money)

Materials:

(For Activities One and Two)

- Punch Out Money (Orfan, Vogeli, Krulik & Rudnick, 1988) separated and stored in plastic bags (class set) -- Each bag contains 16 pennies, 6 nickels, 11 dimes, 6 quarters, 2 half-dollars
- Money Math Cards (Goodnow & Hoogeboom, 1992)
- Coins for the Overhead Projector (Creative Publications, 1993)
- Checklist for Money Math Card: Finding Exact Amounts
- Checklist for Money Math Card: Making Exact Change
- Teddy Bear Counters (Creative Publications, 1993) (one bucket of 300 bears -- 75 each red, blue, yellow, green) sorted randomly into 6 containers
- Overhead Teddy Bears (Creative Publications, 1993)
- Money Bingo (Trend Enterprises, 1977)
- Bell
- Overhead projector
- Overhead markers coordinated with teddy bear colors
- Student pencils, paper, crayons

(For Activity Three)

- Small plastic containers (i.e. margarine containers, pudding cups) for each pair of students/business partner
- Ten-twenty dollars in change (quarters, dimes and nickels)
- Plastic gloves (for handling food)
- Trays (to display food)
- Tables
- Napkins
- Posterboard (to make signs)
- Markers (to make signs)
- Cookies (depending on size of school population)
- Money wrappers

Instructions to Students:

There are three major activities in this unit; each has several setups. Instructions for each are given on the following pages.

ACTIVITY ONE

The activity helps students learn the value of different coins.

There are two parts in Activity One. In Part One, students are divided into three groups. Within a class period, each group will rotate through all three stations, spending approximately 15 minutes at each station. The stations are guided by either a teacher or business partner. This setup is used weekly for approximately 8-10 weeks.

In Part Two, students are given a large group demonstration of an activity, and the business partners and teacher move around the room interacting with groups of students. This setup is used once at the end of this assessment activity.

Part One

Students will work at three different stations, spending approximately 15 minutes at each station. Students are instructed to take their pencil and bag of punch-out money with them as they rotate through the stations. They are responsible for making sure they have all of their materials with them at all times. In this classroom, they move from station to station at the sound of a bell.

Directions for Stations One and Two: Money Math Cards

The partner or teacher at each station has several Money Math Cards: Finding Exact Amounts and recording sheets for each student. Students are given a recording sheet. Holding one card up for all of the children to see, the business partner will say, "Please take out the following coins" while pointing to the coins illustrated in the upper

half of the card. The business partner will read the directions on the card to the students, and students will follow the given directions. They will record their responses on the recording sheet. The business partner will monitor and assist students with their responses. Recording cards are collected before students move to the next station. A similar process is followed at Station Two, but with different Money Math Cards. A checklist to assess student progress is completed by the partner or teacher. (A sample checklist is included at the end of this section.)

Directions for Station Three: Money Bingo

The business partner is given the Money Bingo game. A student passes a bingo card and markers to each student in the group. Students are instructed to familiarize themselves with the money amounts on their card. To begin the game, the business partner draws one money card at a time and calls out the money value. Students cover the square that has the same money value. The first student to cover all squares (or sections of the card, i.e., top half) wins the game. The business partner observes and assists where necessary. Students are also encouraged to assist other students.

Part Two: Teddy Bear Grab

Teacher demonstrates this activity using the overhead projector. First, explain to the students the materials they will need for this activity: container of bears, crayons to match the colors of the bears, pencils and erasers, a student worksheet, and a bag of punch-out money.

The teacher demonstrates this activity by placing the overhead teddy bear transparency on the overhead and taking a handful of bears and placing them on top of the transparency. Bears are separated into groups by colors. Each color has a

corresponding money amount assigned to it (as shown on the transparency). Starting with largest amount (i.e., blue -- $.25), the teacher records the number of blue bears by drawing a blue dot for each bear. Groups of bears are recorded similarly in the order illustrated on the transparency. After the dots are recorded for a given handful of bears, the students are instructed to select the corresponding coins for each group of dots. For example, if there are two blue dots, students place two quarters below the blue dots. After all corresponding amounts of coins are placed under the groups of dots, students are instructed to total the amount of coins and write the total on the given line. The teacher completes two examples, and then asks the students for directions on how to complete the third example. Sharing a bucket of bears with 3 others, students are instructed to work individually to complete their worksheet. Upon completion of the worksheets, students are asked to consider the following questions:

(1) What was the least amount of money collected? What bears were represented?

(2) What was the highest amount of money collected? What bears were represented?

(3) What are the similarities and differences in these amounts?

(4) Did anyone come up with the same amount of money more than once? Compare the bears in each instance. Tell me about that.

The teacher then collects all worksheets and students are instructed to return all materials to their proper places.

ACTIVITY TWO

This activity gives students practice in making change with coins. There are two parts for Activity Two. In Part One students and business partners are given a large group demonstration of an activity. This setup is used at the beginning of this assessment activity.

In Part Two, students are divided into three groups. Each group rotates to one of three stations. Within a class period all groups will rotate through all three stations.

Each group spends approximately 15 minutes at each station. The stations are guided by either a teacher or business partner. This setup is used approximately two weeks.

Part One: Making Change

Teacher demonstrates this activity using the overhead projector. First explain to the students the materials they will need for this activity: pencils and erasers, a student worksheet, and a bag of punch-out money.

The teacher demonstrates this activity by placing an overhead transparency of Making Change Card 1 on the overhead. The teacher asks a student volunteer to read the card aloud. The teacher models the money amount needed using overhead coins. Student responses to the problem are solicited by the teacher. Use overhead coins to model the solution. Next, the teacher uses an overhead transparency of the recording sheet to model the method to be used to record students' answers. The teacher and students complete two examples of this activity.

Part Two

Students will work at three different stations, spending approximately 15 minutes at each station. Students are instructed to take their pencil and bag of punch-out money with them as they rotate through the stations. They are responsible for making sure they have all of their materials with them at all times. In this classroom, they move from station to station at the sound of a bell.

Directions for Stations One and Two: Money Math Cards

The business partner is given two Money Math Cards: Making Change, and recording sheets for each student. Students are given a recording sheet. Holding one card up for all of the children to see, the partner will say, "Please take out the following coins" while

pointing to the coins illustrated in the upper half of the card. The business partner will read the directions on the card to the students, posing the situation for which they will make change. The students then follow the given directions and record their responses on the recording sheet. The business partner will monitor and assist students with their responses. Recording cards are collected before students move to the next station. A similar process is followed at Station Two but with different Money Math Cards. A checklist to assess student progress was completed by the partner or teacher. (A sample checklist is included at the end of this section.)

Directions for Station Three: Money Bingo

The business partner is given the Money Bingo game. A student passes a bingo card and markers to each student in the group. Students are instructed to familiarize themselves with the money amounts on their card. To begin the game, the business partner draws one money card at a time and calls out the money value. Students cover the square that has the same money value. The first student to cover all squares (or sections of the card, i.e., top half) wins the game. The business partner observes and assists where necessary. Students are also encouraged to assist other students. This station repeats the large group session in Activity One to allow students more practice in matching coins to an amount of money.

ACTIVITY THREE: Bake Sale

During this activity, students apply what they have learned about making change to a real-life situation as they sell cookies to other students in the school.

There are four parts in the activity. In Part One, students are given a general overview of the activity and the class will generate suggestions on how to complete this task. In Part Two, students will make signs and gather other necessary materials. In Part Three, students, business partners and teachers will prepare for and conduct a bake sale. In Part Four, students, business partners and teachers will clean up and count the money.

Part One

Students are informed that they will hold a bake sale at school during lunch and that the Anderson's General Store will provide cookies for the sale. Brainstorm with students to determine what needs to be done to prepare for the bake sale. The following items may be identified:

- Make signs for promoting the sale and price information
- Where to hold the sale (location in building)
- Items necessary to sell cookies
- Money needed for change
- Picking up cookies for sale
- Assign tasks to students/teachers/business partners

Part Two

Students will make signs promoting the bake sale and display them throughout the school building. Students will make announcements on the public address system informing the student body of the upcoming sale. Necessary materials are brought to school. At this time, teachers need to pair up students and plan a rotation of pupils with the teacher/business partners.

Part Three

Prior to beginning the sale, these tasks need to be completed:

- Separate coins into containers
- Place cookies on trays
- Set up tables with trays, napkins, gloves and coins

- Display sign listing prices and kinds of cookies
- Student pairs decide who will handle the food and who will handle the money.

Directions for the Bake Sale: Students are reminded to be polite to all customers. When customers approach students are to ask, "May I help you?" After the customers choose their selection, student pairs must agree on the total amount of sale. Inform the customer of the amount owed. After the customer pays, the student pair counts money and determines if any change is needed. If so, the pair needs to agree on the amount and hand the change to the customer. Then hand the customer cookies.

Students put the money in the correct containers. Teacher/business partner oversees all transactions. The sale continues in this manner until the lunch period is over or all cookies are sold.

Part Four

Students, under the guidance of the business partners and teachers, will clean up the area used during the sale.

Divide money containers among student pairs. Students are to count the money and record the amount. Student pairs then switch money containers and count the money in the different container. Check with first amount. If there is a discrepancy, a third counting will be necessary to verify amount. Business partners and teachers will roll money for the bank.

Scoring:

Criteria:

- Activity One
  - Student confidence in ability to recognize coins and their relationships; understand values; and make change
  - Examples might be:
    - Ease in choosing correct coins for specified amount

- Demonstrate a variety of ways to represent a specific amount of money
- Show at least one way to solve the given task

- Activity Two
  - Student confidence in ability to understand values and make change
  - Examples might be:
    - Ease in choosing correct coins for specified amounts
    - Demonstrate a method for finding the correct amount of change (i.e., counting up, missing addend)
    - Ability to complete task independently, versus needing adult assistance

- Activity Three
  - Observation was used to make sure each money transaction was made correctly

Criteria Development:

Activity One. Criteria were developed based on a consideration of desired learning outcomes. These outcomes were established through teachers' perceptions of students' mathematic experiences in previous years. Students were not involved in developing the criteria because this activity was started before students had any background in developing these kinds of ideas.

Activity Two. Criteria were developed based on a consideration of desired learning outcomes. Students suggested that their success be partially determined by the ability to complete the task independently or with assistance. Students also wanted to be able to explain their answers.

Equity Issues:

Activities One and Two. Two issues were taken into consideration when developing this activity: (a) student's ability to speak openly in front of large groups, and (b) eliminating bias against non-readers/non-writers. With regard to the former issue, group sizes were kept to a minimum (i.e., 6-8 students) to reduce student anxiety. For the latter, the business partner read aloud all directions.

Issues and Implications:

Student Confidence: For the bake sale, some students were still not completely confident in their skill at making change and thought they would not be comfortable making change for older students. This was resolved by identifying other jobs for them to choose (i.e., setup, cleanup, etc.). Students stated their preference.

Impact:

For students. In the small group situations, students were more willing to ask for help. In the bake sale, they were excited to use real money and enjoyed selling the cookies. The class will now plan to spend their profits.

For the business partners. They were able to observe a wide range of student abilities through the various activities, and were also able to observe growth in student ability over time.

For the teachers. They were able to gain a better understanding of students' abilities and confidence levels in the small group activities, and they were able to receive feedback regarding students' abilities to deal with money in a real life situation.

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MONEY MADE MEANINGFUL

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Dave Ruff, Store Manager
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Brian Corry
Marianne Hutson
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Cindy Blanton
Patty Morgan
Other members of the Bakery Department

Checklist for Money Math Card: Finding Exact Amounts

Student's Name	Recognizes Coins	Counts out money	Can do more than one way		Recognizes Coins	Counts out money	Can do more than one way		Recognizes Coins	Counts out money	Can do more than one way	√+ √ √-

Checklist for Money Math Card: Making Change

Student's Name	Counts out amount	Can make change	Can do fewest coins	Needs help	Card #		Counts out amount	Can make change	Can do fewest coins	Needs help	Card #	√+ √ √-

A STUDY OF BATS

Topic:	**Mathematics and Science**
Grade Level:	**Grade Two**
School:	**Georgian Heights Elementary, Columbus Public Schools**
Partner:	**American Electric Power/Columbus Southern Power**

Summary of Activity:

The activity described in this section is part of an integrated science unit on bats. This particular activity emphasizes the use of math graphing skills and survey processes. The business partner instructed the students on how to set up a graph to compare results between schools. Following the graphing activity, business partners participated in the assessment by interviewing students.

Learning Outcome:

To develop an understanding of bats through the use of the scientific process of analysis and presentation of data.

Assessment Information:

Methods:	• Student presentation of survey • Interview by partners
Purposes of Assessment:	• Teacher use for monitoring student progress • Student use for self-reflection • Parent conferencing
Social Structure:	• Individual or small group • The teacher/business partner works closely with each student/small group in carrying out this assignment
Time:	• Four sessions of approximately one hour
Materials:	• Bat survey • Pencils, crayons, graph paper, chalk/chalkboard
Instructions to Students:	Prior to beginning this assessment activity students learned about bats (i.e., habitat, body structure, food, types, etc.), surveying techniques, and graphing. Then each group of students visited another second grade classroom

in the school and administered the Student Bat Survey. Also, a copy of the Student Bat Survey was mailed to another second grade in a different school.

When the student survey results were returned, the teacher/business partner instructed the students on how to set up a graph to compare the results between the two schools (see examples). In small groups, students then completed the data analysis and prepared for a presentation of their analysis to the whole class. As students presented their results, the teacher used a checklist to assess the project. The business partners then interviewed the students concerning their perceptions about graphing.

Scoring:

Criteria:

- Teacher Checklist
  - Did the student's presentation format include only one question per page?
  - Were the data separated by schools?
  - Did the student account for both "yes" and "no" responses?
  - Was the student consistent in the placement of "yes/no" responses for each question and for each school?

- Business Partner Interview with Student
  - The student provides a response and justification to the following questions: (a) Tell me two reasons why graphing is important. (b) Tell me how we might use graphing in everyday life.
  - The student must explain the answer to the following question: Looking at your graph, describe the difference between the two schools in their knowledge of bats.

Criteria Development:

Students were not involved in developing the criteria. The criteria were developed by the teacher in cooperation with the business partners based on curricular requirements. Students were informed in a general sense, of the criteria prior to beginning the lessons.

Equity Issues: Even though the teacher and business partner were aware of the potential for gender or cultural bias, this did not appear to be a problem for this activity.

Issues and Implications:

Organization of Time: This activity required more time and organization by the teacher/business partner than was originally expected. For example, the number of sessions originally planned to complete this activity was two. As it turned out, the total number of sessions needed was four. Even though students had experience with "simple" graphing, the concept of double graphing was new and required additional instructional time.

Impact:

Cooperative efforts among teachers, business partners, and students were enhanced. This activity required all parties to work more closely with each other because of the difficult level of the content. The teacher and business partner each brought a different level and type of expertise to the activity. At some point, all participants were involved in the learning process.

Student awareness of graphing and its applications were greatly enhanced. Awareness of the use of graphing in everyday life was increased. For example, one student said, "Graphing can be used to compare my height each year." Another student said, "You could graph the class grades on an assignment."

Business partners became more aware of student needs for understanding the application of concepts to everyday life. Partners saw firsthand the importance (as well the difficulty) of presenting abstract conceptual knowledge in such a way that students were able to grasp its application and use for everyday situations.

A STUDY OF BATS

Submitted by:

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Georgian Heights Elementary
Columbus Public Schools

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American Electric Power/Columbus Southern Power

STUDENT BAT SURVEY

USE TALLY MARKS (𝍸)

	YES	NO
1. ARE BATS BIRDS?		
2. HAVE YOU EVER SEEN A LIVE BAT?		
3. ARE BATS PESTS?		
4. DO BATS ATTACK PEOPLE?		
5. ARE YOU AFRAID OF BATS?		
6. ARE BATS USEFUL?		
7. DO BATS HAVE FINGERS?		
8. DO BATS LIVE ALL OVER THE WORLD?		
9. DO BATS LIVE IN OHIO?		
10. CAN BATS CRAWL?		

OPENING MY EYES TO THE WORLD

Topic: Science
Grade Level: Grade One
School: Harmon Elementary, South-Western City Schools
Partner: Solid Waste Authority of Central Ohio

Summary of Activity:

The following primary environmental unit heightens students' awareness about the natural world and the interconnectedness of man. The children's conceptual schemata is expanded and adjusted through simulations, observations and constructions. The assessment of growth and expanded understanding is accomplished by the use of observations, checklists, interviews and journals. Partners were involved in developing assessment criteria and assisted with individual conferences.

Learning Outcome:

Students will approach science through inquiry and discovery using hands-on experiences.

Assessment Information:

Methods:
- Observation and interview
- Student journals

Purposes of Assessment:
- To establish a baseline of each students' ability to apply knowledge about science concepts related to animal behavior and habitat and to record information about the environment
- For a view of students' progress over time

Social Structure:
- Students worked individually and within small groups

Time:
- Journal writing takes approximately 25-30 minutes per session for three sessions
- Individual reading/writing conferences take approximately 2-3 minutes per student

Materials:
- Story paper journals
- Writing supplies

Instructions to Students:

Each child was given a pine cone. They were instructed to spread peanut butter on the pine cone with their fingers or a craft stick. The pine cones were then rolled in bird seed. A piece of string was given to each child to tie onto their feeder for hanging. Students were encouraged to hang their feeders at home.

In the first writing session, the students responded to "Did you like the pine cone project? Describe what you liked about it. Describe what you did not like about it." In the second writing session, the students responded to "Where did you hang your pine cone feeder? Why did you choose that location?" In the third writing session, the students responded to "What animals might use your feeder," through writing, illustrating or both.

Two weeks after completion of the project, the students were shown four animal pictures (seal, tiger, bird, squirrel). The children were interviewed individually and asked to look at the four pictures and color the appropriate response for each of the following questions:

1. Would a bird feed from your pine cone feeder? If yes, color it.
2. Would a tiger feed from your pine cone feeder? If yes, color it.
3. Would a squirrel feed from your pine cone feeder? If yes, color it.
4. Would a seal feed from your pine cone feeder? If yes, color it.

Scoring:

Criteria:

- Teacher Checklist
  - Does the student understand concepts related to birds and their habitats?
  - Did the student like the activity?
  - Does the student need additional instruction?
  - Is the student able to apply what he/she has learned?
  - Is the student able to hypothesize what other animals might use his/her feeder?
  - What is the student's comfort level with his/her own performance/ability?

Criteria Development: Criteria were developed by a team of grade level teachers and business partners who were interested in obtaining in-depth information over time about students' interest in science, their ability to evaluate their own progress, and to judge students' critical thinking skills.

Equity Issues: During the lesson, a discussion was held concerning what to do if the student lived where no tree existed for hanging the feeder. Students came up with alternative placements, i.e., railing, grandparent's tree, or from the roof.

Those students unable to tie the string for the feeder were encouraged to seek a classmate, teacher or business partner for assistance.

Issues and Implications:

Student's Developmental Abilities: At this grade level, some students had difficulty expressing their thoughts in writing. For this reason, teachers and business partners relied on illustrations and individual reading/writing conferences. Students' lack of writing ability could have become an assessment bias in this instance but was avoided by utilizing reading/writing conferences.

Student's Comfort Level: At this grade level, some students are uncomfortable about touching items that can get their hands dirty. For this reason, teachers and business partners relied on alternate methods for the students to prepare the pine cone.

Impact:

Development of activity. With the business partners' assistance, this activity came to fruition and provided meaningful insights into the children's understanding of processing information and applying it.

Partner insights. Business partners developed an awareness of the variety of dwellings in which the students reside. This became an issue when some students stated that they did not have a tree in which to hang their feeder.

OPENING MY EYES TO THE WORLD

Submitted by:

Carol Gibson and Jill McIntyre
Harmon Elementary
South-Western City Schools

Susan Wilson
Solid Waste Authority of Central Ohio

Peg Hanley
Eisenhower National Clearinghouse

PUFF AND SCORE

Topic:	Science
Grade Level:	Grade Three Intermediate Developmentally Handicapped
School:	Georgian Heights Elementary, Columbus Public Schools
Partner:	American Electric Power/Columbus Southern Power

Summary of Activity:

Students participated in "Puff Mobiles," a group problem-solving activity. They were asked to design and build a straw sail car that used the wheel as a simple machine. A rubric was used to evaluate how the group solved the problem. The business partner worked collaboratively with the teacher throughout the children's participation in "Puff Mobiles" and analyzed the data from the assessment rubric.

Learning Outcome:

Working in small groups, the student will investigate a problem and develop a solution to that problem.

Assessment Information:

Method:
- Long term project scored with analytic rubric or analytic checklist

Purposes of Assessment:
- To assess individual growth in problem-solving within a cooperative group
- For use by teachers and business partners as a way of improving instructional effectiveness
- As a way of developing cross-grade level curriculum materials for classroom use by business partners and teachers

Social Structure:
- Small groups ranging from three to six students in a group

Time:
- Approximately one hour per session for four sessions

Materials:
- Puff Mobile Directions (AIMS, 1987)
- non-flexible plastic drinking straws (10 per group)

- one-inch wooden beads with holes large enough for straws to go through easily (4 per group)
- straight pins (approximately 20 per group)
- sheet of paper, 8-1/2" x 11", (one per group)

- Puff Mobile Checklist or Puff Mobile Analytic Rubric (Teacher Copy and Student Copy)

Instructions to Students:

Prior to the assessment activity, the students participated in instructional activities regarding problem solving (see AIMS, 1987 – Puff Mobile Directions).

After this, students were arranged in small groups. They were told they would be evaluated, using a rubric, on how well they worked together as a group solving a problem. The problem centered on deciding how to design and build a sail car that would go the farthest. Depending on whether the teacher chose to use the Puff Mobile Checklist or Analytic Rubric, the students were given a copy of the scoring criteria. The teacher then explained the scoring method and criteria: "You are going to be evaluated on how well you state the problem. If you do it well, you get 2 points. If you do it somewhat, or half-way, or not clearly, you get 1 point. And if you don't state it at all or misstate it, you get no points." The other two criteria were explained similarly. Students were evaluated as they progressed through this activity.

Students worked in groups on this activity approximately one hour per session for four sessions. As students worked cooperatively, the teacher/partner moved from group to group observing and questioning (when necessary) how well the group performed according to the criteria on the rubric.

Scoring:

Criteria:

- State the problem
- List logical solutions to the problem
- Evaluate possible alternative solutions and choose an appropriate solution for the group
- Develop an appropriate design that reflects the group's solution
- Test their possible solution accurately
- Evaluate and draw logical conclusions from the results

Criteria Development: In this particular activity students were not involved in developing the criteria. The criteria and the instructional activity were one in the same. The problem-solving process involves the steps that were evaluated and students were aware from the beginning they would be responsible for using these steps.

Equity Issues: Groups were established by the teacher to ensure that they contained a combination of (1) males and females, and (2) readers/writers and non-readers/non-writers.

Issues & Implications:

Student-Centered Language: Students were not familiar with educational terms used in the initial rubric (see Teacher Copy). In other words, students did not know, nor was it important for them to know, the meaning of the term "able to evaluate and draw logical conclusions from the results." Instead, the teacher could say, "If it (project) does not work, fix it so it does work." Consequently, the rubric was revised to reflect student-centered language (see Student Copy).

Grade-Level Communication and Planning: This activity was done by several classes from the same grade level. Communication was a problem; there was not enough time to coordinate and discuss any problems as they arose. If this activity is to be done by a whole grade level, it is important to build in time to coordinate the activity. The suggested amount of time would be a minimum of approximately 1/2 hour per week.

Degree of Subjectivity of the Assessment: Most teachers who participated did not view this type of assessment as subjective, but one teacher was concerned that it might be viewed as biased or arbitrary especially by parents. She felt it was a good way of keeping up with how students are learning, but worried that using techniques such as observation to determine if a group is working successfully could be very subjective.

Impact:

Once the criteria were developed, grading was viewed as easy and an effective way of evaluating students. (See additional comments in Issues and Implications section.)

Integration of assessment and instruction was included. It was important for the two to be blended, as opposed to using more separate methods, such as exclusively using an end of the chapter test.

This method of evaluation addresses more learning styles than traditional testing. Students who are leaders, followers, and creative/artistic types come together to work on problems. This mode of assessment better reflects real-world contexts.

References:

AIMS Education Foundation. (1987). Puff mobiles. Seasoning Math and Science: Spring and Summer Second Grade - Book B. Fresno, CA.

PUFF AND SCORE

Submitted by:

Debbie Rehl, Angela Rivera-Nieves, and Antoinette K. Wolfe
Georgian Heights Elementary
Columbus Public Schools

Andrew Koch and Tom Zarbaugh
American Electric Power/Columbus Southern Power

Name _____

Analytic Rubric -- Teacher Copy

A.

2	Able to state problem clearly
1	Writes a problem but does not state it clearly
0	Misses the problem completely

B.

2	Able to list logical solutions to the problem
1	Able to list solution which may not be logical
0	Unable to list any solutions

C.

2	Able to evaluate possible solutions and choose an appropriate one for this group
1	Evaluates solutions and chooses a solution but does not express logical reasoning in their choice
0	Unable to make a choice

D.

2	Develops an appropriate design that reflects the group solution
1	Develops a design which does not reflect on the solution chosen by the group
0	Does not develop a design

E.

2	Able to test their possible solution accurately
1	Able to test their possible solutions but not accurately
0	Does not test their possible solution

F.

2	Evaluates and draws logical conclusion from their results
1	Evaluates but does not draw logical conclusions from their results
0	Does not evaluate

Total _____/12

Name _____

Analytic Rubric -- Student Copy

A.

2	Able to state problem clearly
1	Writes a problem but does not state it clearly
0	Misses the problem completely

B.

2	Solutions that make sense
1	Solutions that may or may not make sense
0	Unable to list any solutions

C.

2	Chose your best solution for your group
1	Does not choose the best solution from their list
0	Unable to make a choice

D.

2	Makes a model based on their choice
1	Makes a model that does not go with the group
0	Does not make a model

E.

2	Able to test their model
1	Able to test their model without accuracy
0	Not able to test their model

F.

2	Fixes model after testing, if needed
1	Notices problems but does not fix them
0	Unable to see problems in the model

Total _____/12

Puff Mobile Checklist

Group _____

Yes	No	A.	Able to state the problem
Yes	No	B.	List possible solutions
Yes	No	C.	Evaluate and choose the most appropriate solution
Yes	No	D.	Test solution
Yes	No	E.	Evaluate test
Yes	No	F.	Re-test alternative solution
Yes	No	G.	Draw conclusion from the test

WHY ARE THEY ENDANGERED?

Topic: Science
Grade Level: Grade Two
School: Longfellow Math/Science Magnet School, Westerville City Schools
Partner: Battelle

Summary of Activity:

The following second grade science unit focuses on the study of endangered species through students' individual research. The culminating activity for this unit of study took place when the students presented their findings to the class.

A checklist and rubric were developed from class-generated criteria to assess the presentation. The business partner was involved by researching the topic of endangered species and sharing the information with the class.

Learning Outcomes:

To investigate the conditions on earth today which have contributed to the endangerment of a species. To develop an awareness of the species that are endangered in our world today.

Assessment Information:

Methods:
- Oral presentation assessed through use of a checklist (by the students) and rubric (by the teacher)

Purposes of Assessment:
- Student self-reflection
- Teacher use for grading

Social Structure:
- Students work on their project independently, and later work in pairs to complete the peer assessment

Time:
- Approximately 45 minutes per session for 3-4 sessions per week. (The total project takes about 2 months to complete because of the time needed for students to write their reports using the computer.)

Materials:
- Many resources on endangered species
- Folders for student work
- Posters, paper
- Computers
- Video camera (optional)

- Performance Standards Rubric
- Presentation Checklist

Instructions to Students:

In this project, students were asked to choose an endangered species they wanted to learn more about. Using the resources available in the classroom, they began their research by investigating facts about the animal. They were then challenged to think and write about why the animals are endangered and what we can do to save them from extinction. As students gathered information, they entered it into the computer. They were also asked to draw a picture of their animal (using either the computer or poster paper).

To prepare for an oral presentation, the students were to select the information they wanted to share with the class. At this point, the class discussed the criteria to be used to assess the presentation. They were asked, "What types of things would be part of a good presentation on an endangered species?" At the end of the discussion, the teacher summarized and restated the criteria as suggested by the students (see "Presentation Checklist"). The students then used this information to continue their work on the presentations.

When the students felt their project was complete and they were ready to make a presentation, they were asked to find a peer partner and try out their presentation (peer assessment). The peer partner used the "Presentation Checklist" to judge the presentation. This information was given back to the presenting student so he/she could prepare for the final presentation to the class.

During the final presentation the teacher used the "Performance Standards" rubric to judge the student's work. Also, (optional) the teacher may video tape the student's presentation for use in parent conferences.

Scoring:

Criteria:

- Presentation Checklist (peer assessment)
  - Did the presentation tell you facts about the animal? (yes/no)
  - Did the presentation give you information on why the species is endangered? (yes/no)

- Did the presentation give ways to protect the species? (yes/no)
- Was the presenter organized? (yes/no)

- Performance Standards Rubric (teacher assessment -- the teacher selects the single best description of the student's work)
  - The student fully accomplished the purpose of the task. The presentation covered the major criteria including facts about the animal, reasons why the animal was endangered, and the ways in which the species can be preserved. The presentation was well organized. The student communicated effectively. (Level 4 -- well done)
  - The student satisfactorily completed the presentation. The student covered the major criteria although some detail may be missing. The presentation may lack good organization. The student communicated the information successfully. (Level 3 -- acceptable)
  - The student did not fully achieve the purpose of the task. The student may be missing some of the major criteria set for this task. Elaboration on the criteria is needed. The presentation lacked organization. The student did not communicate the information successfully. (Level 2 -- revision needed)
  - The student did not accomplish the task. The work needs redirection to meet the criteria. (Level 1 -- begin again)

Criteria Development: As a group, the class developed the criteria for the "Presentation Checklist." From this, the teacher structured the "Performance Standards" rubric. The number of criteria generated by the students was minimal as it is best for children of this age to focus on only a few criteria at one time.

Equity Issues: One issue that might arise with this activity would be the possibility that there might be students who are not comfortable giving an oral presentation or who may have neurological disabilities which affect the ability to give an oral presentation. If this is the case, then special considerations will have to be made for these students.

Issues and Implications:

Time: This project took much more time than anticipated because of the use of the computers. However, the students remained enthusiastic and motivated throughout the course of this project. Students appeared to benefit from the indepth study of endangered species. This project will be repeated again next year, but more time will be allocated.

Impact:

The students enjoyed the opportunity to present information they gathered to the class. This was a valuable learning experience for them. Also the parents enjoyed the opportunity to view their child's presentation on video.

WHY ARE THEY ENDANGERED?

Submitted by:

Mary Petrovic
Longfellow Math/Science Magnet School
Westerville City Schools

Pamela Booker
Battelle

Presentation Checklist

1. Did the presentation tell you facts about the animal?	YES	NO
2. Did the presentation give you information on why the species is endangered?	YES	NO
3. Did the presentation give ways to protect the species?	YES	NO
4. Was the presenter organized?	YES	NO

Name of presenter:
Your Name:

Performance Standards

Assignment:_____ Date:_____

Level		Standard to be achieved for performance at specified level
4	WELL DONE	The student fully accomplished the purpose of the task. Their presentation covered the major criteria including facts about the animal, reasons why the animal was endangered, and the ways in which we can preserve the species. The presentation was well organized. The student communicated effectively.
3	ACCEPTABLE	The student satisfactorily completed the presentation. The student covered the major criteria although some detail may be missing. This presentation may lack good organization. The student communicated the information successfully.
2	REVISION NEEDED	The student did not fully achieve the purpose of the task. The student may be missing some of the major criteria set for this task. Elaboration on the criteria is needed. The presentation lacked organization. The student did not communicate the information successfully.
1	BEGIN AGAIN	The student did not accomplish the task. The work needs redirection to meet the criteria.

MONEY WORKS

Topic: Mathematics
Grade Level: Grade Five
School: Ohio Avenue Elementary, Columbus Public Schools
Partner: National City Bank

Summary of Activity:

The following "Money Works" authentic assessment banking unit incorporates simulations of "real world activities" such as consumer shopping and check writing. Mental math, an important part of the NCTM's standards, is developed in the "Allowance Game" and the game entitled "Pay the Banker."

This learning episode describes how students can be engaged in a challenging authentic learning environment. A natural outgrowth of this type of environment is the implementation of an authentic assessment strategy which includes observations, checklists, anecdotal records, and checkbook balancing.

This project was designed and produced through the combined efforts of the fifth grade teachers, their mathematics class and their business partner, National City Bank. The partner contacted many other employees from the bank and got them involved in working with the children. She also arranged to have the word processing done for the project and duplicated the game boards so that they could be used by small groups in the classroom. Another partner worked with the children on how to write checks, how to make deposits and how to make withdrawals. The bank provided the checkbooks and covers. Employees from the bank took the children on a field trip to the bank and explained different jobs in banking and how the various banking processes work. When the children did their presentations on banking, employees came to observe. Bank employees returned to see how the class was doing with their check writing and to help the children balance their checkbooks. The partners operated a store at the end of the year and provided items to be sold so that students could write checks and buy items using the balances in their checkbooks which they have earned by engaging in good behavior throughout the year.

Learning Outcome:

Through simulations, students will earn money and maintain checking accounts.

Assessment Information:

Methods:
- Students were involved in simulations - money games, a school store, and keeping checking accounts. Students

were assessed through teacher observations and checklists at the money games and school store. While students were entering and crediting amounts in their checking accounts for good behavior and while students were recording debits and writing checks for inappropriate behavior, the students were assessed by the teacher through anecdotal records and observations, and paper/pencil assessment.

Purposes:

- The teacher will use the assessment tools for students grades and for sharing with parents at conferences. This will help review the development of student progress over time. The games and school store will give the students practice in a) counting amounts of money, b) subtracting and making change, c) recording amounts of money, and d) mental math. The checking account will help the students learn how to write checks, make deposits, make debits and balance checkbooks.

Social Structure:

- Large group (entire class)
- Small groups (3-4 students)
- Individually

Time:

- Approximately twelve sessions of 45 minutes each over a period of about three months

Materials:

- "The Allowance Game"
  - Paper money (Media Materials 1985) and coins: quarters, half-dollars, dimes, nickels, pennies to be separated and stored in plastic bags or boxes. Each bag or box contains approximately 25 of each coin.
  - One die
  - Game markers - one for each player
  - Poster board (22 x 28 in.)
- "Pay the Banker Game"
  - Paper money (Media Materials 1985) and coins: half-dollars, quarters, dimes, nickels, and pennies to be separated and stored in plastic bags or boxes. Each bag or box contains approximately 25 of each coin.
  - One die
  - Game markers - one for each player
  - 12 "chance" cards for the shaded areas. The cards direct the children to collect money from

the bank, or pay money to the bank depending on the instructions on the card.
    - Poster board (22 x 28 in.)
- Classroom Checklist
- Checking Account Packet (6 pages)
- School Store - a smaller version of the real school-wide store. School supplies such as papers, pencils, folders, etc. are sold within the classroom. Two students are the cashiers who handle the money for the sales as students come to purchase items.
- Checking Accounts
    - Non-negotiable checks from National City Bank
    - Check covers
    - Check register
    - Black or blue ink pens for checks
    - Red ink pens for withdrawals
- Final Store Project - one-day store project at the end of the year National City Bank provides items to be sold and students write checks using money from their accounts to pay for items they select

Instructions to Students (for the money games):

<u>Money Game One: "Pay the Banker," A Small Group Simulation</u>

The first activity called "Pay the Banker" is a game which involves counting money and making change. One student is selected to serve as banker. The banker gives each player $1.00. Each player puts a marker on the start area of the game board. The 12 chance cards are placed face down.

The first player rolls the die and moves the marker the number shown on the die. If it stops on a space showing an amount of money, the player collects that amount from the bank. If the players land on a space that is shaded, they must draw a card from the stack of 12 cards and follow the instructions.

The winner is the player with the most money after all have reached the end.

At the end of the game each student will count the money they have and record the amount using a dollar sign and a

decimal point. The student will also write the amount in words.

The players should make change using the fewest coins and bills possible. The role of the banker should be shared among various students.

The teacher should initially model how the game is to be played using a small group of children. Students are given approximately 30 minutes to play the game.

Two to five players may play the game.

Material Preparation: The materials needed for this game consisted of a game board (see "Game Board - Pay the Banker" for illustration of game board and twelve chance cards). Divide the dollar sign shape into small areas on which amounts of money are written or areas are shaded. The amounts of money are less than $1.00.

Cut twelve chance cards and on them write directions such as:

- You found some money and get a reward. Collect 67¢.
- Property taxes are due today. Pay 58¢.
- You must license your bicycle. Pay 27¢.
- You caught the bank robber. Collect 52¢.
- Your savings earn you interest. Collect 45¢.
- Fire insurance is due. Pay 39¢.
- Interest on your loan is due. Pay 43¢.
- Sales tax on new roller skates. Pay 18¢.
- You mow the lawn. Collect 50¢.
- You share your money with friends. Pay everyone 12¢.
- Your dog got loose. You are fined. Pay 17¢.
- Gasoline tax must be paid. Pay 26¢.

For assessment, the teacher observes students as they play the game and uses the "Classroom Checklist" to record observations. Prior to the game, students are informed of what the teacher will be looking for (e.g. "I will be noting whether you are able to do this without assistance from me or others in your group, or whether you need a little assistance, or whether you need a lot of assistance").

Money Game Two: The Allowance Game, A Small Group Simulation

The second activity "The Allowance Game," builds on the money counting skills learned previously.

To start this activity, students will work in groups of 2 - 5. One student is selected to serve as banker. The banker gives each child $2.00. Each player puts a marker on "Go" on the same board (see "The Allowance Game" for illustration of game board).

The first player rolls the die and moves the marker the number of spaces indicated on the die. The players follow the instructions as they move along the game board. A player collects a 75¢ allowance when he/she pass the "allowance" space on the board. Each player may put $1.00 in the bank. If players have a dollar in the bank when they pass the "your savings earn you interest" space, they collect 50¢.
If players land on the double space, they roll again and move the number indicated on the die. The amount is doubled on that space whether it is collected or paid. If a player lands on the rental zone, it can be purchased for $1.00 or 85¢ can be paid for rent. If the player purchases this area, anyone who lands on it must pay the owner 85¢ rent.

Play continues with each player taking turns in order for approximately 30 minutes.

The winner is the player with the most money when the game ends. At the end of the game players will count the money they have and record the amount using a dollar sign and a decimal point. Each player will also write the amount in words.

As the students work, the teacher observes individual students using the "Classroom Checklist". Students can also play this game during indoor recess or during free time and with adult volunteers (in this case, their special friends from National City Bank).

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Instructions to Students (for the checking account):

Checking Account: Large Group Overview

Prior to beginning the large group overview with the class, instruction had been provided in previous class sessions on how to keep a checking account. After introducing the topic of checking accounts, the following questions were asked to stimulate a discussion: "Can anyone tell me what a checking account is? Why do people have checking accounts?" After discussion of the questions, the teacher passes out an information sheet on checking accounts. Students read the sheet together aloud. A discussion about the sheet is initiated and a question and answer period follows. The students are told that a speaker from the bank will come the next day to talk to them about checking accounts.

The next large group session is started with the introduction of the speaker from National City Bank. He began his activity by drawing a picture of a bank building on the chalkboard and having a student draw a picture of a piggy bank. He asked the question "What is the difference between the two banks?" The student responded and then a discussion on banking was started. The banker talked about the difference between savings accounts and checking accounts and gave a detailed description of checking accounts.

The banker passed out the "Checking Account Packet" of 6 papers to each student (see appendix). He went over each page of the packet with the students. For example, he had students volunteer to read each section of the first page, then he explained that section and asked for questions. The page gave an illustration of a check with its parts labeled. The banker then helped students apply their learning to the check.

The fourth sheet reviewed the rules for writing checks. The banker again asked for volunteers to read each rule then had discussion and asked for questions.

The fifth page was a practice sheet for the students. They had to practice writing the amount for checks in both figures and words. The banker had the students write out

the first five amounts and they reviewed them together. He encouraged them to continue to practice.

The final page gave an example of a check written out correctly and a blank check for the students to practice writing a check. The banker had the students fill out the blank check to the person named and for the amount given, then sign their name on the check. When students finished filling in the check, they were each given a "real" check that was non-negotiable to fill out to whomever they wanted to and for whatever amount. (The students were so excited, you would have thought the checks were real.)

As the students worked on this activity both the banker and teacher circulated among the class to observe individual students working. This activity lasted approximately 1-1/2 hours. Near the end, the students were told to exchange checks and to examine each others checks for mistakes.

Checking Account: Large Group/Individual

To start this activity, each student was given his/her own checkbook containing a checkbook cover, check register and twenty-five non-negotiable checks. (These items were donated by National City Bank.) The students wrote their name and number in their checkbooks. The number was the number given to each student at the beginning of the school year that corresponds with their book numbers.

The teacher drew an enlargement of a check register page on the chalkboard and labeled each section. She went over each section and explained how to fill it in. Some examples were filled in to show students how to enter and debit the register. Students volunteered to enter and debit the register on the board. The teacher asked if there were any questions. This session took approximately 30-45 minutes.

The next class session was spent reviewing all information previously given on the checkbook register. After about ten minutes review, the students were told how they could earn money for deposits and what behaviors would warrant debits. When students receive papers back for class work and tests, they are given money amounts

for the grade earned. These amounts may be entered into their checkbook register. For inappropriate behaviors, parent phone calls, time out, etc., amounts are debited from the register. The following are charts that are posted in the classroom for earned amounts and debits.

Regular Papers
A = $.25
B = .15
C = .10
D = .05

Tests
A = $1.00
B = .75
C = .50
D = .25

Fines	
190 (Discipline action)	$1.00
Bus Write Up	.75
Letter Home	.50
Call or Home Visit	.50
P.E.A.K.	1.00
Suspension	1.00
Inappropriate Behavior	.50

After a review of all the above information, each student was given back some papers to calculate the total amounts. The teacher then met with each student individually to be sure the student was adding and entering the amounts received into the register correctly. It took two sessions to meet with all the students individually. The sessions were 30 minutes each.

For each inappropriate behavior, the student wrote their name on the chalkboard, the teacher also keeps a list, and as misbehavior occurs a check mark is added beside the name. If a student must go to time out or PEAK (in-school suspension) the teacher receives a slip which she keeps to be recorded later by the student. At the end of the week the totals are calculated for the inappropriate behaviors and the student must write a check to the teacher for that amount and debit his/her check register.

The teacher keeps all checks in envelopes with the student names on them. Students may also write checks to purchase pencils, paper, pens, and erasers from the teacher. This procedure continued throughout the year.

At the end of the school year, five National City Bank employees came to the classroom to help the students, who worked in small groups of 4 - 5 students each, balance their check registers. In June, the teacher along with National City Bank, set up a store for the students to use money earned throughout the checking account project to purchase items donated by the bank.

Scoring:

Criteria:

- Money Games

  √ + student was able to a) count amounts of money, b) subtract and count back change, c) record amount of money

  √ student was able to do the above with some (but minimal) assistance from the teacher or members of the group

  √- student was unable to do the above (even with assistance). For example the student was unable to count amounts of money, count back change or write money amount. The student didn't know that 50¢ plus 25¢ was 75¢.

- Checking Accounts

  As the students worked on calculating the amounts of money earned from papers, the teacher sat at a table taking one student at a time to be sure calculations and entries were done correctly using the anecdotal record to make notes.

Criteria Development:

In the money games the criteria were developed by teachers and students, by deciding together what they should be able to do when the games were over. It was agreed that each student would know how to count

money, record money amounts and count back change using the fewest coins and bills possible. Students were reminded just before the game what would be expected of them.

For the checking account the criteria were developed by the teacher. Students were not involved in the initial development because the teacher had to work with established curricular criteria. Students were informed about the criteria prior to beginning the lesson.

Equity Issues: There were no problems with equity issues in these activities. The groups consisted of male and female, black, white and Hispanic. Everyone worked together very well.

Issues and Implications:

Time Extended: Originally 30 minutes were allocated for the money games but the children enjoyed them so much that they begged to come in at recess and play the games. The time was extended.

Impact:

For the teacher. These activities helped to review the development of student progress over time.

For the business partners. The banker who spoke to the students about checking accounts and the people who worked with the children on balancing their check registers valued those roles because they were the school's business partners.

For the students. The students are learning to write checks, make deposits, and debits and learning the responsibility of keeping track of their points. The students want to come in at recess to play the money games. They have certainly improved on counting money and making change.

For parents. The activities were shared with the parents at parent conferences. Some parents came to a "Make-It, Take-It" workshop. A Family Math Night was held -- parents played the games with the children.

References:

Creative Publications (1993). Oak Lawn, Illinois

Media Materials (1985). Toy Money. Baltimore, Md.: Media Materials, Inc. under Berne & Universal Copyright

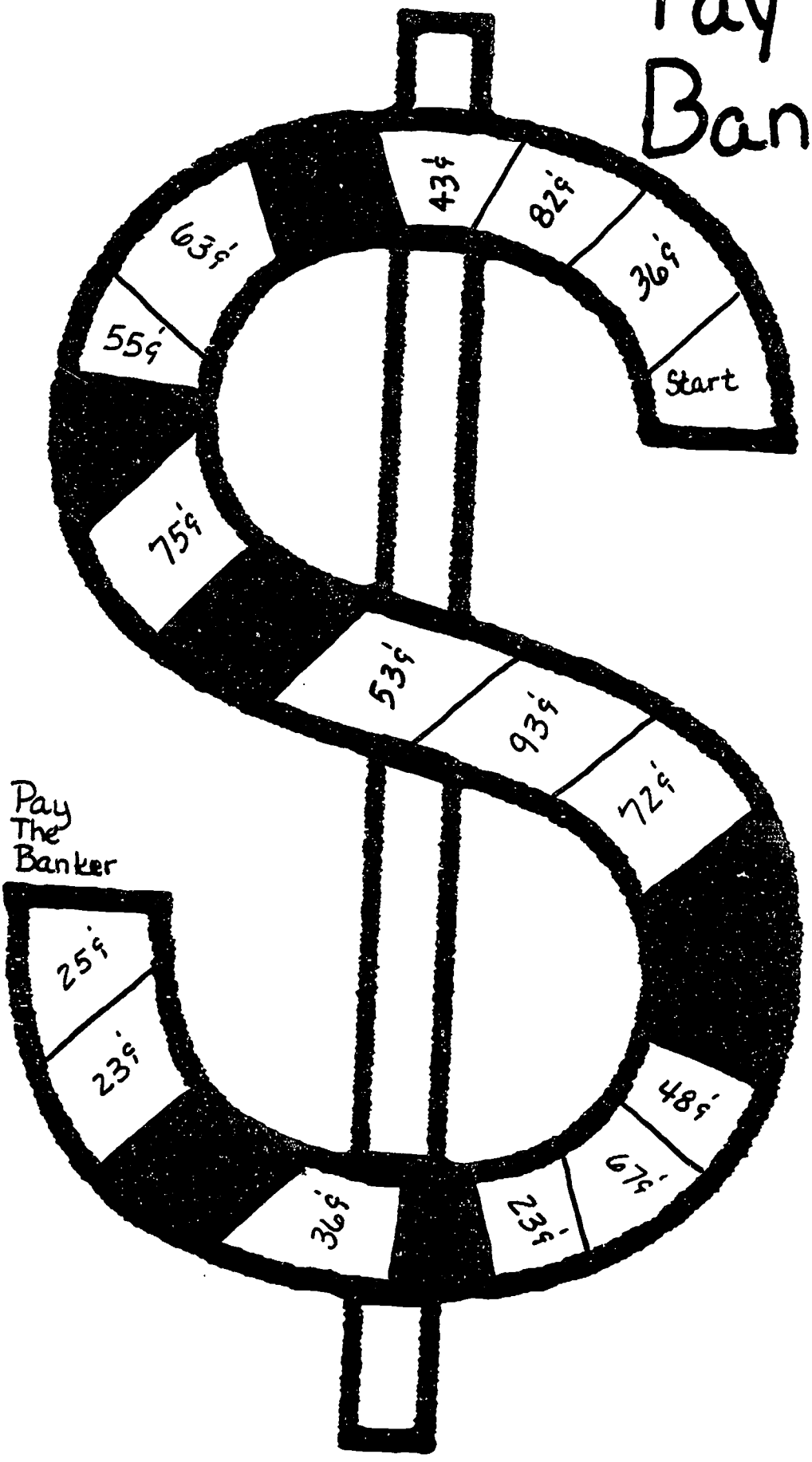
MONEY WORKS

Submitted by:

Oretha Rose and Anette Smith
Ohio Avenue Elementary
Columbus Public Schools

Carolyn Melvin
National City Bank

Pay the Banker



Savings & Loan	You mowed the lawn $1.65	Popcorn Party 65¢	Lost homework Lose a turn	You bought a new CD Pay $1.75	$1.00 You lost a tooth	School supplies pay 75¢	Rental Zone 85¢
** Double**							You made your bed 85¢
It's Movie Time $1.35							Broke a window! Oh no! Lose a turn
Babysitting earns you $1.75							It's your birthday! You earn $1.50
Hurray! Move Ahead 3 spaces							M&M's pay 5¢
Lunch Money 95¢ "Munch over dude"							** Double **
Washed car Earned $1.30							Don't Boo Boo Go Ahead 2 spaces
You need Crayons 45¢							50¢ Thanks for Cleaning the Garage
Roll Again	Shoveling Snow $1.45	School Dance 35¢	Lose Next Turn	You delivered papers 75¢	Class Pizza Party 75¢	Sold Goldfish $1.35	Collect Allowance 75¢

The Allowance Game

CLASSROOM CHECKLIST

Student Name	Score	Comment

√ + Student was able to correctly make change, count amounts of money, and record amounts of money without assistance

√ Student was able to correctly make change, count amounts of money, and record amounts of money with some assistance

√ - Student was unable to make change, count amounts of money and record amounts of money even with assistance

Checking Accounts

A checking account is very helpful to you if you use it wisely. It costs a little each month, but not too much if you use your checking account wisely. As you grow older and have a family you will have more bills to pay. A checking account can make paying bills by mail very easy. Your checking account can be a great help to you in paying your bills and helping to keep your budget records straight. A checking account is not hard to operate and keep accurate records if you learn the correct way of doing it. This chapter will show you a step by step way of opening and operating a checking account. Checking accounts in most banks operate in the same way. So if you learn the information in this chapter well, you should be able to open and operate you own checking account. If you feel you may have any problems with your checking account, the people at your bank will be glad to help you. All you have to do is ask.

Before we go on and learn how to open and operate a checking account, let's find out some of the reasons people want to have a checking account.

WHY HAVE A CHECKING ACCOUNT?

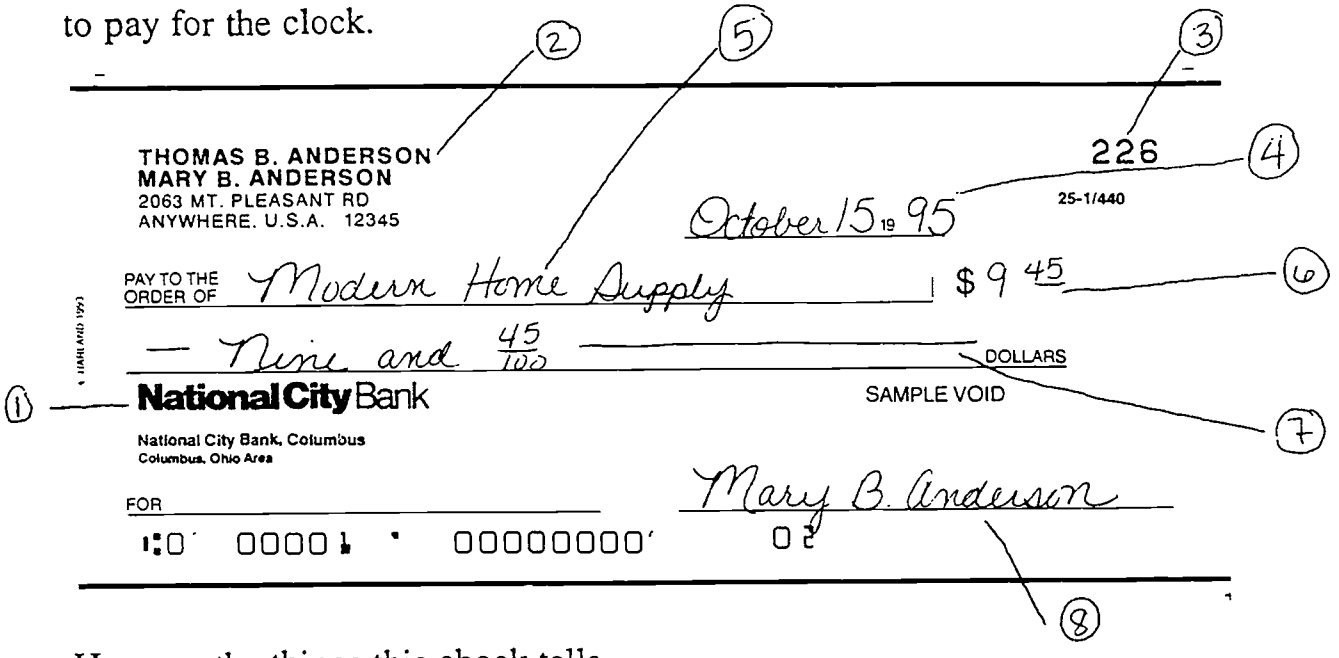
Some people do not have a checking account and some people should not have a checking account because they cannot operate them correctly. The people that do have a checking account and can operate them correctly know how convenient a checking account can be in their daily lives.

Some of the ways a checking account can help us are:

1. We do not have to carry large amounts of cash with us. When we want to buy something we can write a check.
2. It is safer to pay bills through the mail when you send a check, instead of cash.
3. A check can be a record that you have paid a bill. After you pay a bill by check, the cancelled check comes back to you from your bank. The cancelled check shows that the bank paid money to the person you wrote the check to. This cancelled check is your receipt that shows you paid the bill.
4. A checking account helps you keep a record of the bills you have paid and makes your monthly budgeting easier.
5. The bank helps you keep your checking account records correct. The bank will send you a monthly statement showing all of your deposits, the amount of each check you wrote and the service charge to the bank. Along with your statement you will receive the cancelled checks you wrote for the month.

Understanding Checks

Mary bought a clock from Modern Home Supply. Here is the check Mary wrote to pay for the clock.



Here are the things this check tells.

1. The name of the bank where Mary has her checking account.
2. Mary's name and address. This shows that the check is one of Mary's checks.
3. The number of the check. The checks are numbered in order, so the next check Mary writes will be Number 227.
4. The date. Mary wrote this check on October 15.
5. The name of the person Mary made the check out to. Modern Home Supply will cash this check to get their money.
6. The amount of the check written in numbers. Mary wrote this check for $9.45.
7. The amount of the check spelled out in words.
8. Mary's signature. Mary must sign her name on the check before her bank will cash it and pay Modern Home Supply.
9. Mary's account number.

Here is another check. Study it carefully. Then answer the questions below.

THOMAS B. ANDERSON
MARY B. ANDERSON
2063 MT. PLEASANT RD
ANYWHERE, U.S.A. 12345

227

25-1/440

April 29 1994

PAY TO THE ORDER OF Martin Stern $ 27.49

Twenty seven and 49/100 DOLLARS

National City Bank

SAMPLE VOID

National City Bank, Columbus
Columbus, Ohio Area

FOR

Thomas B. Anderson

⑈0 00001 • 00000000 02

1. Who wrote this check? _____

2. At what bank does Thomas Anderson have his checking account? _____

_____

3. Where does Thomas Anderson live? _____

_____

4. To whom did Thomas Anderson make out this check? _____

_____

5. What is the number of this check? _____

6. On what date was this check written? _____

7. What is the amount of this check? _____

8. In how many places on the check is the amount shown? _____

Writing Checks

When Mary opened her checking account, the bank gave her a list of rules for writing checks. These rules showed her the correct way to write checks.

RULES FOR WRITING CHECKS

1. Always use a pen to write a check. Never write a check with a pencil.
2. Never change figures on a check. If you make a mistake, tear up the check and write a new one.
3. Fill all blank spaces on the check with words, numbers, or lines.
4. Be sure to use the correct date.
5. Never write a check for an amount greater than the balance in your checking account.
6. If a check is lost or stolen, ask the bank to stop payment on it.

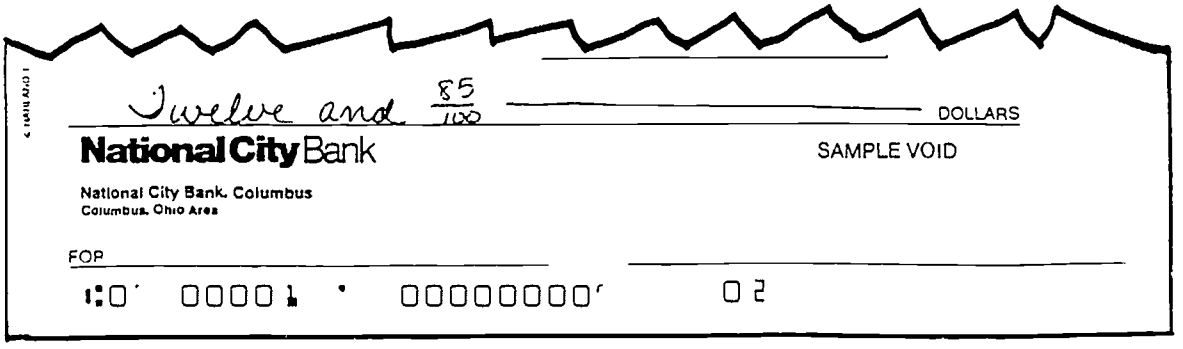
Mary also learned how to write the amount on the check both in figures and in words.

Write the amount in figures close to the dollar sign ($) on the check. Write the figure for cents smaller that the figure for dollars. Then draw a line under the cents figure.

$ 12.^{85} — This

$ 12.85 — Not this

On the next line write the amount of dollars in words. Then write "and." Then write the amount of cents in hundredths.



The amount of the next check Mary wrote was $9.67.

She wrote the amount in figures like this. $ 9.67

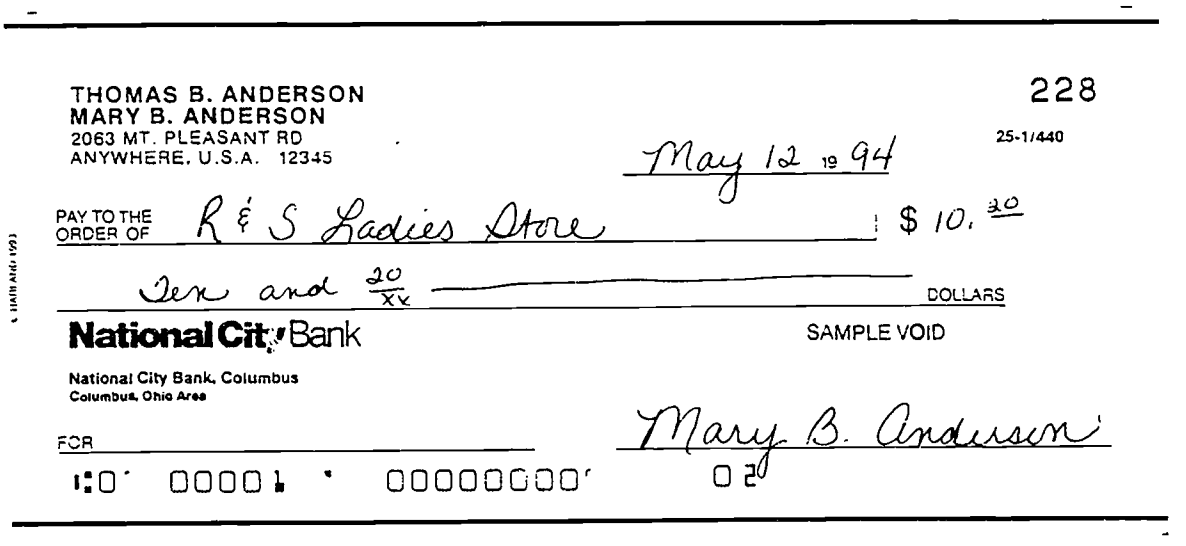
She wrote the amount in words like this. Nine and 67/100 DOLLARS

Practice writing these amounts for checks in figures and in words.

	Amount	Figures	Words
1.	$8.52	$ 8.52	Eight and 52/100 DOLLARS
2.	$5.69	$ _____	_____ DOLLARS
3.	$7.80	$ _____	_____ DOLLARS
4.	$16.97	$ _____	_____ DOLLARS
5.	$10.22	$ _____	_____ DOLLARS
6.	$9.51	$ _____	_____ DOLLARS
7.	$20.82	$ _____	_____ DOLLARS
8.	$13.63	$ _____	_____ DOLLARS
9.	$25.12	$ _____	_____ DOLLARS
10.	$12.39	$ _____	_____ DOLLARS
11.	$31.40	$ _____	_____ DOLLARS
12.	$22.33	$ _____	_____ DOLLARS
13.	$4.10	$ _____	_____ DOLLARS
14.	$19.18	$ _____	_____ DOLLARS
15.	$29.05	$ _____	_____ DOLLARS

Writing Checks

Mary bought a shirt at the R&S Ladies Store. She wrote this check to pay for the shirt.



THOMAS B. ANDERSON
MARY B. ANDERSON
2063 MT. PLEASANT RD
ANYWHERE, U.S.A. 12345

228
25-1/440

May 12 19 94

PAY TO THE ORDER OF R & S Ladies Store $ 10.20

Ten and 20/xx DOLLARS

National City Bank
National City Bank, Columbus
Columbus, Ohio Area

SAMPLE VOID

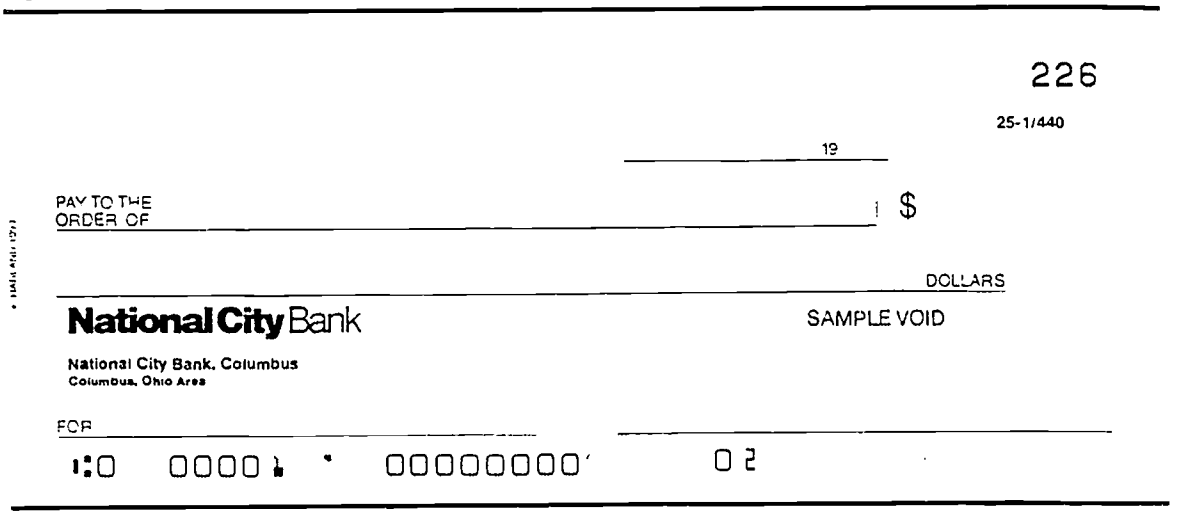
FOR

Mary B. Anderson

⑈0 00001⑈ 00000000 02

Study the check that Mary wrote. Then make out the check on this page and the next for the amount shown. Use today's date and your own signature.

1.To Jennifer Snyder for $32.28.



226
25-1/440

19

PAY TO THE ORDER OF $

DOLLARS

National City Bank
National City Bank, Columbus
Columbus, Ohio Area

SAMPLE VOID

FOR

⑈0 00001⑈ 00000000 02

CHECK IT OUT

Topic:	**Mathematics**
Grade Level:	**Grade Five**
School:	**Pointview Elementary, Westerville City Schools**
Partner:	**Banc One Services Corporation**

Summary of Activity:

As a part of a consumer mathematics unit, students maintained a checking account and had monthly income and expenses. In this activity students learned to make pie charts and bar graphs based on consumer information that they discovered as they analysed and tabulated their income and expenses. The students developed their own four point rubric system of grading for teacher use and for self-assessment scoring. Students learned how graphs are used in everyday consumer applications. The activity described proved to be very realistic and informative.

The partnership of this project was between Banc One Services Corporation and Pointview Elementary. The Services Corporation worked with fifth grade students in developing a consumer mathematics unit including a checking account system, and a system for graphing results of the students' incomes and expenditures. The Services Corporation developed a team of people to help the teacher with this project. This team supplied each of the students with checkbooks, payroll checks, and bills. They helped in the teaching process, performed the computer work for the project, and took the students on a field trip to the bank. This project could be taught in the classroom without a partnership, but would not include the interaction with banking professionals which helps students envision careers. The partners also help teachers and students see applications and can share in the teaching and preparation responsibilities.

Learning Outcome:

The students will demonstrate an in-depth understanding of consumer math skills.

Assessment Information:

Method:
- Long Term project of consumer skills judged using a scoring rubric

Purposes of Assessment:
- Teacher evaluation of student progress
- Self-evaluation of progress by the student
- For use in parent conferences

Social Structure:	•	Mostly individual activity with some large group discussions
Time:	•	Approximately four sessions of 45-60 minutes in one week
Materials:	•	Consumer Math Assessment Sheet
	•	Figures/Calculation Sheet
	•	Bar Graph
	•	Pie Charts

A consumer math unit was collaboratively developed by the teacher and the business partner. First, the business partner shared information about checking accounts. He used non-negotiable items donated by the bank to show students how to write out and register checks and deposit slips.

Then each student received an individual monthly "income," along with their own "fixed" monthly bills (i.e., rent/mortgage, utilities, and food). After paying their bills, students were permitted to spend the rest of their funds as they wanted. Some chose to save their money, while others chose to spend theirs. As other unexpected bills came due (veterinarian office visits, car repairs, etc.) some children discovered they were overdrawn. All the students soon saw the need for developing and sticking to a budget.

To document the sources of, and the variation in their expenses, students made calculations and then designed both pie charts and bar graphs showing their monthly expenditures. They also combined the expenses of several students, created a group pie chart, and compared their charts to one prepared by the partners. This assessment plan centered around those charts and graphs.

The unit was assessed using the following strategies:

Instructions to Students:

Session 1:

In a large group setting, the students are asked what parts of their long term project they view as examples of work that demonstrates their understanding of the whole Consumer Math Unit. The materials to be used in their assessment are determined by the students (i.e., the group Pie Chart, Bar Graph, and Figures/Calculations Sheet). They are then asked to select the criteria to use in the assessment of those examples. The class then draws up a rough copy of the assessment chart.

Sessions 2-3:
Using the assessment chart, the students individually critique their Pie Charts and Bar Graph. They compare their calculations on the Figure/Calculation worksheet with the results they visually depicted on the Pie Charts and Bar Graphs.

Session 4:
The students are provided with the teacher's assessment score sheet to compare with their own sheet. The students who have a large discrepancy in the total scores will meet with the teacher to explain their reasoning for the scores and revisions will be made as needed.

Scoring:

Criteria:

For each example listed below the work was judged on a four point rubric (See "Consumer Math Assessment Sheet")

- Circle Pie Charts:
  - correct percentages
  - correct labels
  - neatness
  - comments
- Bar Graphs
  - correct totals
  - correct axis labels
  - key
  - neatness
- Group Work on Circle Pie Chart
  - amount of correct input

Criteria Development:

The students were asked what part of the long-term project they wanted to use to assess their in-depth understanding of the Consumer Math Unit. They determined what was to be graded and how it was to be graded using a four point rubric.

Equity Issues:

There were no equity-related problems.

Issues and Implications:

Student Resolution of Discrepancies: While reviewing the Figures/Calculations sheet and pie charts, the students recognized a discrepancy in figures represented on the Pie Charts provided by the business partner versus their Group Pie Charts. This led the students to reflect on their procedures to attain the percentages. They remembered that they had made some adjustments and rounding on some of the calculations for the group pie charts. Pie charts provided by the business partner were more accurate because they did not reflect those adjustments. Therefore, a variance of the percentages needed to be ascertained by the students. Depending on the amount of adjustment made on the individual group pie charts, the students determined that if the group pie charts were correct or within two percentage points of their calculation sheet the rubric scoring of 4 would apply and so on down the rubric.

Scoring: The students were concerned that they might inaccurately score and/or report their progress. This might result in a large discrepancy in the scores between the student and the teacher. The ability of the teacher to determine a fair final grade of assessment might be hindered when comparing inaccurate scoring on the students' part with the teacher's scoring on the assessment sheet. After a class discussion, the students agreed that a teacher-student conference would be needed to provide a time for student explanation and re-evaluation.

Impact:

It was exciting. From a teaching standpoint (by teacher and business partner), it was exciting to watch the students become increasingly active in their own planning, implementing, and scoring of the long term project. The students recognized the importance of accurate assessment while using the criteria they devised for rubric scoring.

CHECK IT OUT

Submitted by:

Katherine Boyd
Pointview Elementary
Westerville City Schools

Marc Kielmeyer
Banc One Services Corporation

Consumer Math Assessment Sheet

	excellent 4	good 3	fair 2	needs much improvement 1
1) Circle Pie Chart A) Correct percentages B) Correct labels C) Neatness Total Score				
2) Bar Graph A) Correct totals B) Correct axis labels C) Key D) Neatness Total Score				

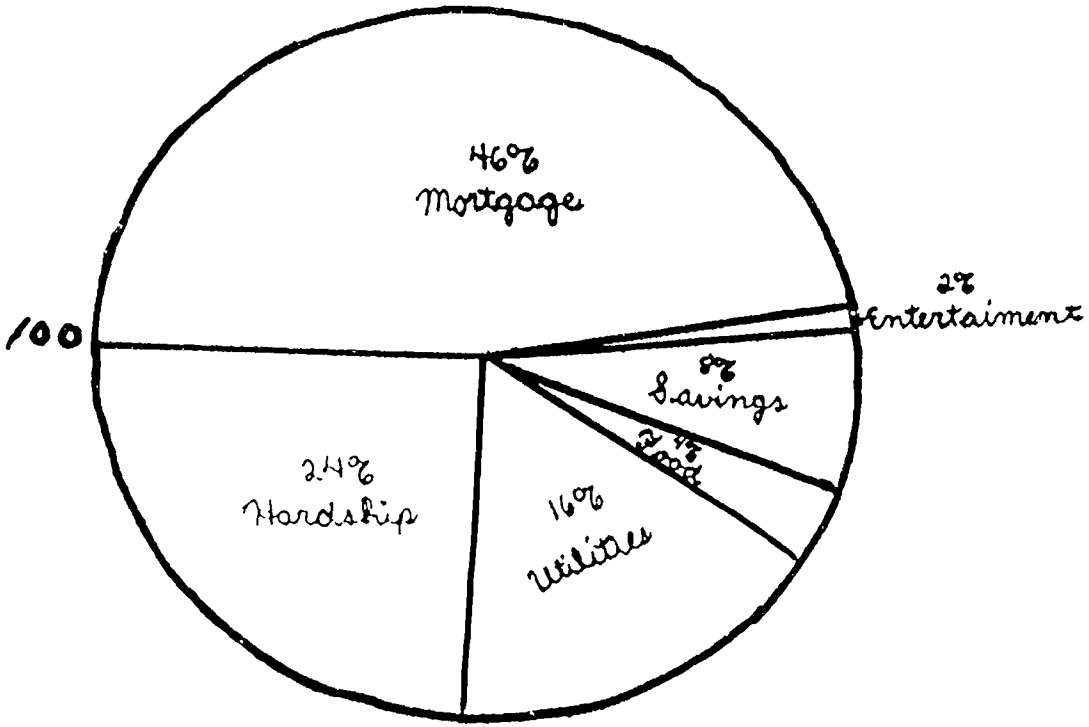
Comments on Group Work - Circle Pie Chart - Amount of correct input scored on rubrics 4,3,2,1.

1) We Learned ...

2) We found an answer by ...

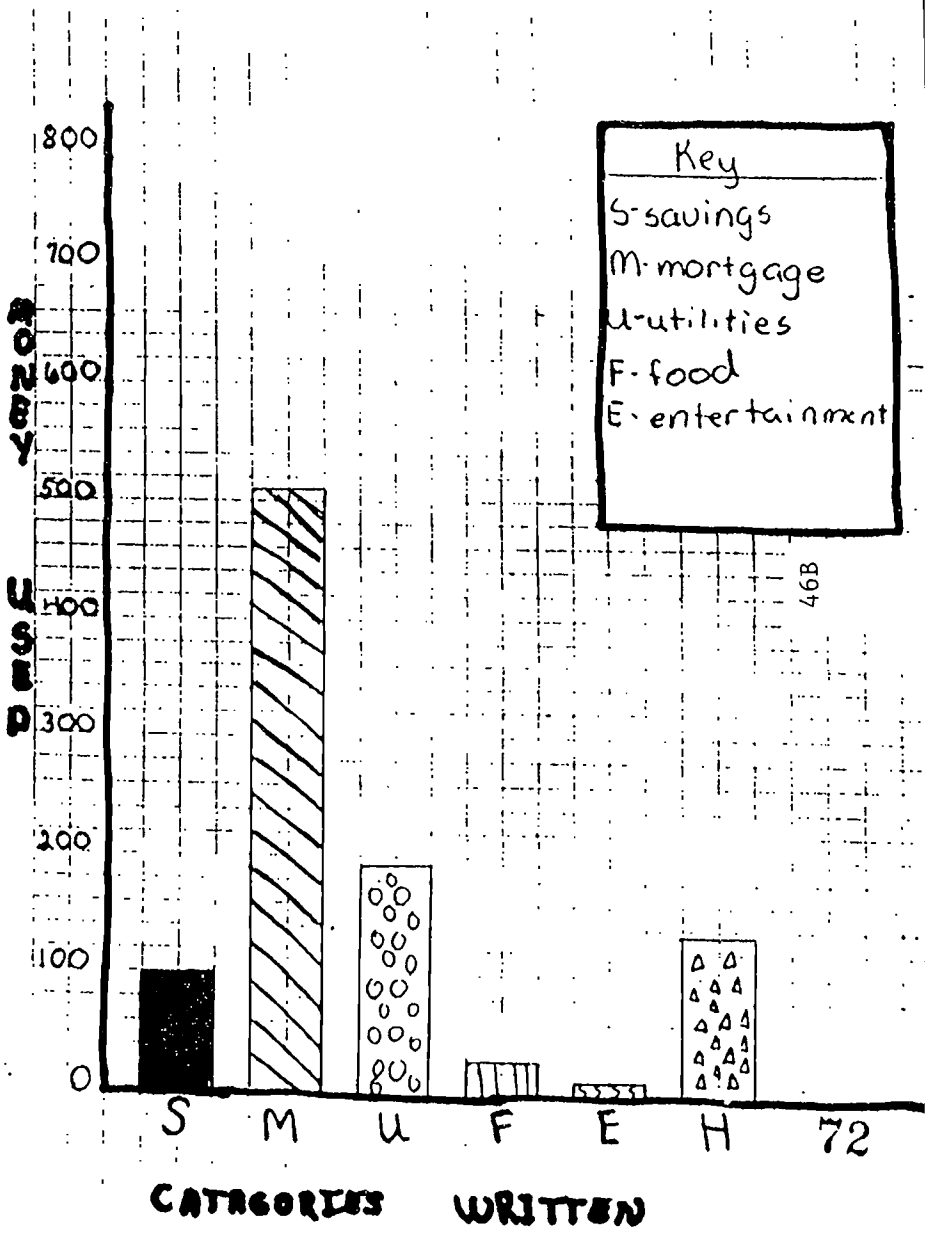
3) After we found an answer, we ...

Name_____



Name Holley B.

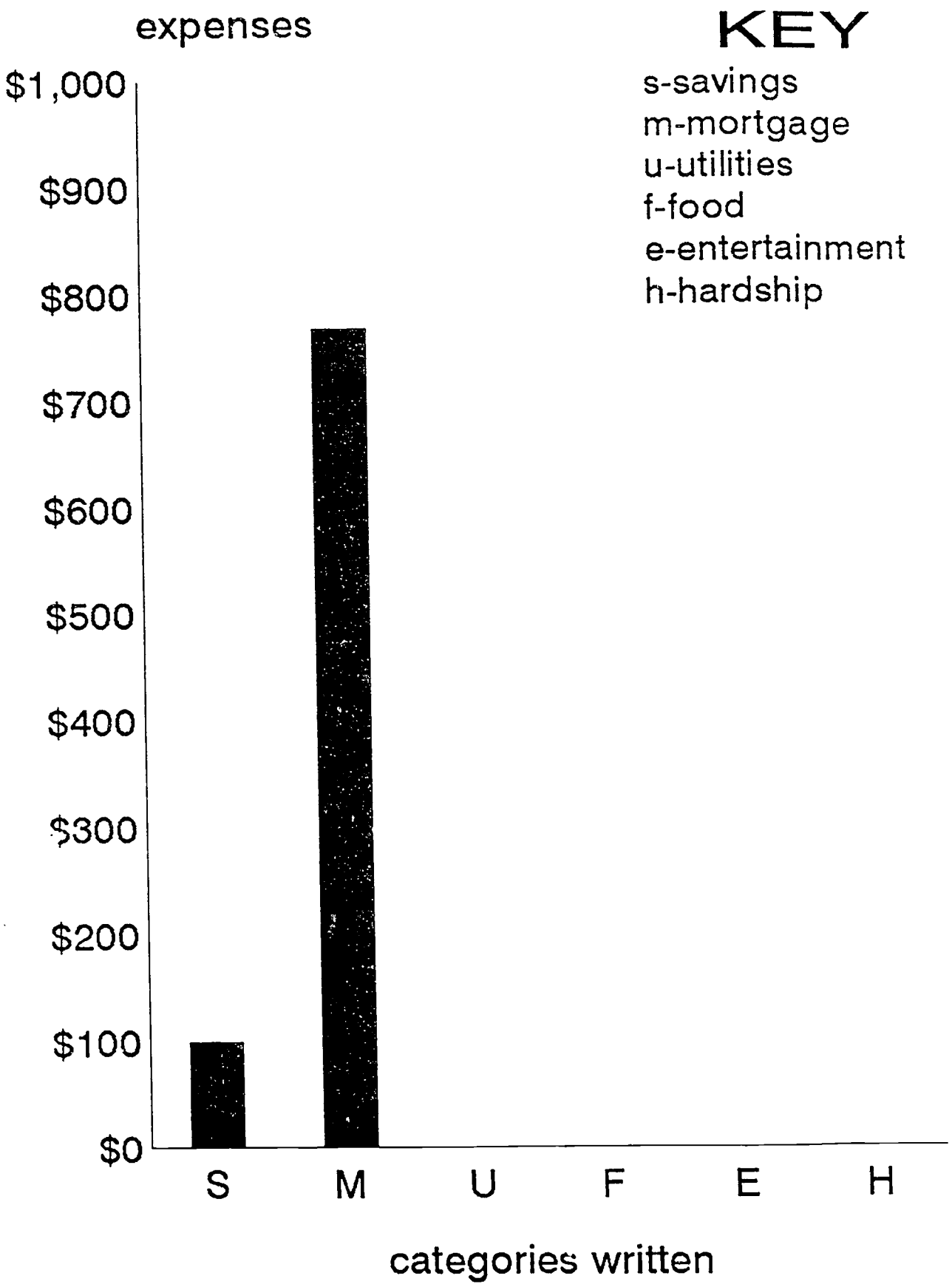
71



Figures / Calculations

1) Circle Pie Chart +, ÷, %.

2) Bar Graph +


expenses
KEY
s-savings
m-mortgage
u-utilities
f-food
e-entertainment
h-hardship
$1,000
$900
$800
$700
$600
$500
$400
$300
$200
$100
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S
M
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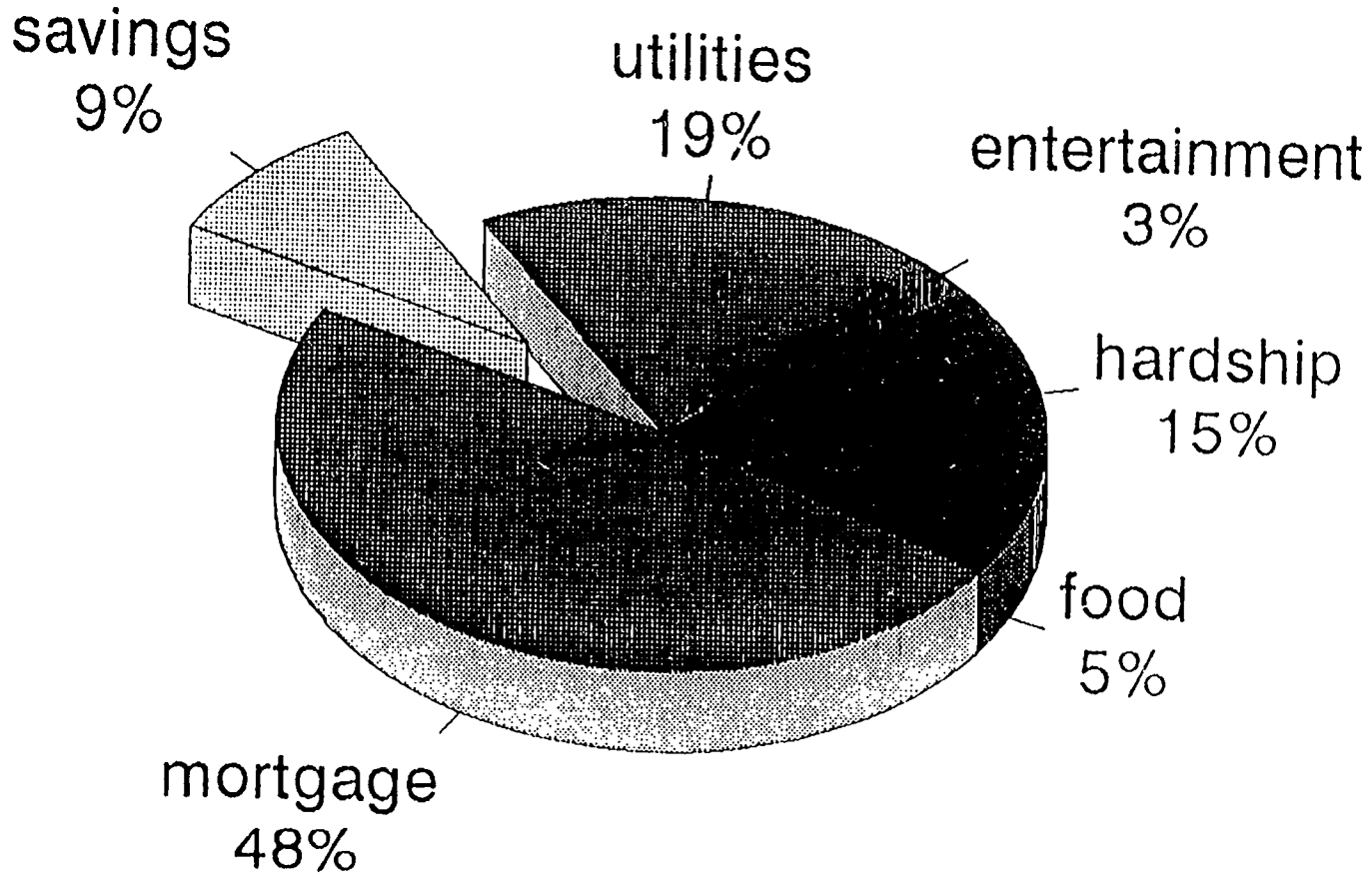
categories written

Monthly Expenses
Math Consumer Unit



Holiy's expenses

ENERGY DIG

Topic:	Science, Social Studies, Language Arts
Grade Level:	Grade Five
School:	Georgian Heights Elementary, Columbus Public Schools
Partner:	American Electric Power/Columbus Southern Power

Summary of Activity:

Students were involved in completing a research project on "Energy Sources and the Effects They Have on the Environment." Students were divided into cooperative learning work groups and researched the following topics: hydropower, petroleum, nuclear, natural gas, coal, biomass, propane, geothermal, wind and solar energy sources. Each student was responsible for writing a report using the information gained through the research process. The business partners worked collaboratively with teachers and students throughout this long-term project.

Learning Outcome:

To develop an understanding of the research process

Assessment Information:

Method:
- Long-term project of research skills assessed through use of a scoring rubric

Purposes of Assessment:
- Student evaluation for a grade
- Feedback for parents
- Student self-evaluation

Social Structure:
- Small groups of 2-3 students each (maximum of 3 students to a group)

Time:
- Approximately one hour per day, each day for six weeks

Materials:
- Classroom Assessment List for Report
- File folder (one for each student)
- Research material on energy sources and the effects they have on the environment

Instructions to Students:

Students worked in small groups on the "Research Project on Energy Sources and the Effects They Have on the Environment."

Before the research started, students were informed about the evaluation procedures. Each student was given a copy of the "Classroom Assessment List for Report." The rubric contained 10 criteria by which their work would be judged. They could receive 5-15 points for each criterion. Work was scored as students progressed through their research.

Scoring:

Criteria: See "Classroom Assessment List for Report"

Criteria Development: Criteria were developed by teachers. Students were not involved in the initial development of the rubric, but based on student comments and reviews some modifications were made. Criteria were selected based on instructional objectives, and were revised following a trial use.

Equity Issues: There is the potential for bias in evaluating a student's work related to higher-order thinking skills. When the student makes a judgment, there is the possibility the teacher could disagree with the judgment. It is important to keep in mind that the judgment is valid if the student is able to support the judgment with relevant and logical facts.

Issues & Implications:

Grade Level Coordination and Planning: This activity was done as a cooperative effort by several teachers in a grade level. It was very important that the teachers were able to work cooperatively in developing, gathering needed resources, and carrying out this project. The planning and grading requires considerable time and effort.

Rubric Revisions: Based on a trial use and feedback from students, parents and others, the weight given to some criteria were modified. For example, the value assigned to "language mechanics" (#9) increased from 5 to 10 points because parents indicated they wanted this area to carry more weight (more

emphasis) in instruction and evaluation. Also, the criterion for "appropriate notes" (#3) needed elaboration based on a review from the principal. Initially, the criterion stated, "turned in notes," and was revised to include "turned in appropriate notes from a minimum of 5 different sources."

Assessment Process: The assessment reflects the importance of evaluating the process rather than just the product. It is very much process oriented.

Impact:

For teachers. This process provided a better understanding of how students progressed than traditional assessment methods typically provide. Also, the teachers were able to respond more quickly to student needs and identify and remediate student mistakes as soon as they occur.

For parents. Parents have more respect for the evaluation process. This method provided more in-depth information about what was occurring in the classroom as well as how the student was progressing. In some cases, this was a positive outcome. Parents had been requesting more information and this type of assessment was a way of providing that. Using the rubric took the mystery out of the evaluation process. On the other hand, parents had expressed frustration because they had a limited background in the content area.

For business partners. This has helped focus the business partners on the instructional process so that their time is more effectively used with students. Also, they were able to get more involved because this topic is closely related to their professional responsibilities.

For the principal. The principal has become more involved. She is more aware of the instructional and evaluation process used in the classrooms.

For the other faculty. Other faculty have become aware of this process through informal conversations and have requested copies of the rubric as well as instructions on how to use and develop other rubrics.

ENERGY DIG

Submitted by:

Lynn Sandin and Gayle Weaver
Georgian Heights Elementary School
Columbus Public Schools

Paul Loeffelman
American Electric Power

NAME _____

CLASSROOM ASSESSMENT LIST FOR REPORT

Element Points	Points Earned
1. **The student uses required concepts.** There are 3 questions worth 5 points each. (15 total points possible) • Answers question completely (5 pts.) • Answers question (4 pts.) • Incomplete answer, relevant (3 pts.) • Incomplete answer, non relevant (2 pts.) • Attempts answer, non relevant, off topic (1 pt.)	
2. **The student uses appropriate information to support concepts.** There are 3 questions worth 5 points each (15 total points possible) • Contains at least 5 relevant facts to support answer (5 pts.) • Contains 4 relevant facts to support answer (4 pts.) • Contains 3 relevant facts to support answer (3 pts.) • Contains 2 relevant facts to support answer (2 pts.) • Contains only 1 relevant fact to support answer (1 pt.)	
3. **The student turned in appropriate notes from a minimum of five different sources.** • Each source is worth 2 points. There must be an average of 15 facts per source. (10 total points possible)	

Element Points	Points Earned
4. The student turned in appropriate outline. (15 total points possible) • Ordered questions appropriately; written in outline form with numerals and letters; contains a minimum of twelve facts for each of the three questions (15 pts.) • Ordered questions appropriately; written in outline form with numerals and letters; contains a minimum of ten facts for each of the three questions (12 pts.) • Ordered questions appropriately; written in outline form with numerals and letters; contains a minimum of eight facts for each of the three questions (9 pts.) • Ordered questions appropriately; written in outline form with numerals and letters; contains a minimum of six facts for each of the three questions (6 pts.) • Not done in outline form and/or fewer then six facts for each of the three questions (3 pts.)	
5. Higher order thinking is evident. (10 total points possible) • Student moves beyond facts; provides several judgments, all of which are well-supported (10 pts.) • Student moves beyond facts; provides several judgments, the majority of which are well-supported (8 pts.) • Student moves beyond facts; provides only one well-supported judgment (6 pts.) • Student moves beyond facts; provides judgment(s) with little or no appropriate support (4 pts.) • Student makes inappropriate judgment and reasoning (2 pts.)	
6. The purpose of the writing is clearly carried out. (10 total points possible) Can document the research trail (i.e., beginning with notes, to outline, to final report) for a minimum of 10 facts; each fact is worth 1 point.	

Element Points	Points Earned
7. **References are properly made.** (10 total points possible) A minimum of five sources are required on the bibliography (1 point each). Also, proper bibliography form is worth 1 point each.	
8. **The writing is organized and focused.** (10 total points possible) • Ideas flow and fit together; details are sequenced in a logical order; related ideas are arranged together (10 pts.) • Ideas generally flow and fit together; details are generally sequenced in a logical order; related ideas are generally arranged together (8 pts.) • Few ideas flow and fit together; few details are sequenced in a logical order; few related ideas are arranged together (6 pts.) • Ideas skip from one to another; many details are not arranged or sequenced in a logical order; related ideas are seldom arranged together (4 pts.) • Organization is nonexistent; ideas do not flow together; details, if included, are not arranged in a logical order (2 pts.)	

Element Points	Points Earned
9. Language mechanics are correct. (10 total points possible) • Words are used consistently and appropriately; sentences are complete; writer correctly applies the rules for standard usage and grammar, punctuation, and capitalization (10 pts.) • Words are generally used correctly and appropriately; most sentences are complete; writer usually applies the rules for standard usage and grammar, punctuation, and capitalization (8 pts.) • Some words are used correctly and appropriately; sentences are complete; in some cases, the writer correctly applies the rules for standard usage and grammar, punctuation, and capitalization (6 pts.) • Words may often by used incorrectly and inappropriately; writing contains frequent fragments and run-ons; writer makes many errors of the rules pertaining to standard usage and grammar, punctuation, and capitalization (4 pts.) • Words are used incorrectly and/or inappropriately; writing consists mostly of fragments and run-ons; writer demonstrates very limited knowledge of the rules of standard usage and grammar, punctuation, and capitalization (2 pts.)	
10. The writing is neat and presentable. (5 total points possible) • Very neat handwriting or typed; no blemishes (5 pts.) • Very neat handwriting or typed; few blemishes (4 pts.) • Legible handwriting; several blemishes (3 pts.) • Sloppy handwriting; most words are legible (2 pts.) • Illegible handwriting (1 pt.)	

Final Report Grade _____

Oral Presentation Grade _____

84

STACKIN' UP THE BUGS

Topic:	Science, Computer Use
Grade Level:	Grade Five
School:	Longfellow Math/Science Magnet School, Westerville Schools
Partner	Battelle

Summary of Activity:

This fifth grade science unit on arthropods demonstrates a way to bring the classroom alive through student-directed learning and student-generated products. The use of Hypercard stacks and creative original models of arthropods requires that students demonstrate knowledge. Consequently, the teacher needs to use alternative methods of assessment such as rubrics and observations.

The teacher and business partner from Battelle worked together to develop an exciting and unique way to present the material in this unit. The partner worked as a volunteer in the classroom to help with hands-on activities involving vertebrates and invertebrates (i.e., looking at worms, investigating grasshoppers, dissecting owl pellets). Sharing his knowledge about scientific investigations and experimentation, he instructed the students in making good observations and recording information in a precise logical format.

Learning Outcome:

To communicate ideas and knowledge about arthropods and use technology in communicating these ideas.

Assessment Information:

Method:
- Long-term project (create Hypercard Stack) to be judged through use of a checklist

Purposes of Assessment:
- Teacher evaluation of student's level of knowledge of arthropods for a grade
- Student reflection of work over time
- For use in student/parent conferences

Social Structure:
- Students work individually in computer lab equipped for use by entire class. (This activity could possibly be done in pairs.)

Time:

- Several class periods of 45-60 minutes each in the computer lab

Materials:

- Computers equipped with Hypercard Program (2.1 Hypercard, 1987-1991, Apple Computers, Inc.)
- P/C Viewer
- Hypercard Examples (3 pages)
- Hypercard Rubric

Instructions to Students:

Following several sessions devoted to the discussion and investigation of arthropods, the entire class will make a Hypercard Stack on Arthropods. The Stack will consist of at least 5 cards with emphasis on the four classes of arthropods and their characteristics. "Buttons" will be used to link all cards, and pictures may be included. A fifth card, or "Home" card, will serve as a Title Page. (See Hypercard Examples). The titles of the four cards will be:

1. Millipedes and Centipedes
2. Crustaceans
3. Spiders, Ticks, and Mites
4. Insects

Upon completion, the Stack will be shared with the entire class by use of a P/C Viewer. The Hypercard Stack will be judged by the teacher through the use of the "Hypercard Rubric." A hard copy of the program will be printed and placed in the student's portfolio for use in student/parent conferences.

Scoring:

Criteria:

- Hypercard Rubric (select the single best description of the student's work)

4 points	The student's use of Hypercard is clear and logical. The student uses buttons well and knows how to navigate around in the stack. The student uses graphics to highlight his/her stack. The concepts and information are organized and focused on the topic and shows evidence of the writing process.

3 points	The student shows some knowledge of using Hypercard. The student uses buttons and graphics to highlight his/her stack but has trouble navigating through the stack. The concepts and information are organized and focused on the topic. The student shows evidence of using the writing process.
2 points	The student's use of Hypercard is somewhat limited. The user encounters problems with using buttons and graphics and has difficulty navigating through the stack. The information and concepts are disorganized and show little evidence of the writing process.
1 point	The student exhibits little knowledge of the use of Hypercard and/or writing process. There is little or no information or concept development shown in the stack.

Criteria Development: The criteria for the Hypercard Rubric was determined by modifying an existing rubric for Hyperlearning (Hibbard).

Issues and Implications:

Technical Problems: In some cases students had difficulty with the use of the machines. For example, several students forgot to save their files and lost the day's work when the machine was turned off. In another instance, the student's computer/program locked causing a loss of the entire stack.

Students having problems with the computer or Hypercard asked for help right away so the teacher was aware of any problems. Adjustments were made immediately so that the teacher and student could be satisfied if an incomplete stack were turned in due to technical difficulties rather than time off task.

Impact:

For the teacher. It was encouraging to see students using the computer as a tool for presentation of material and to see development of knowledge about computers and the Hypercard Program over time.

For the student. Students took pride in developing a stack and sharing knowledge with the teacher and other classmates, as well as taking home a copy to share with their parents.

References:

Hibbard, K.M. Rubrics and classroom assessment lists. Contact: K. Michael Hibbard, Ph.D., Assistant Superintendent, Region 15 Schools, P.O. Box 395, Middlebury, CT 06762.

2.1 Hypercard, 1987-1991, Apple Computer, Inc.

STACKIN' UP THE BUGS

Submitted by:

Charles E. Lozano
Longfellow Math/Science Magnet School
Westerville City Schools

Dr. Peter Taussig
Battelle

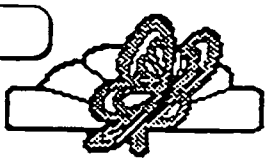
HYPERCARD RUBRIC

NAME _____

ELEMENT	
4	The student's use of Hypercard is clear and logical. The user uses buttons well and knows how to navigate around in the stack. The student uses graphics to highlight his/her stack. The concepts and information are organized and focused on the topic and shows evidence of the writing process.
3	The student shows some knowledge of using Hypercard. The user uses buttons and graphics to highlight his/her stack but has trouble navigating through the stack. The concepts and information are organized and focused on the topic. The student shows evidence of using the writing process.
2	The student's use of Hypercard is somewhat limited. The user demonstrates problems with using buttons and graphics and has difficulty navigating through the stack. The information and concepts are disorganized and shows little evidence of the writing process.
1	The student exhibits little knowledge of the use of Hypercard and/or the writing process. There is little or no information or concept development shown in the stack.

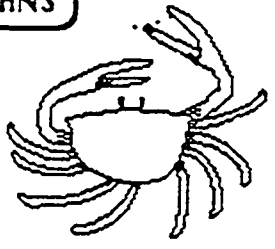
FOUR CLASSES OF ARTHROPODS

INSECTS



SPIDERS, TICKS, AND MITES

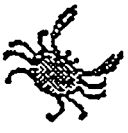
CRUSTACEANS



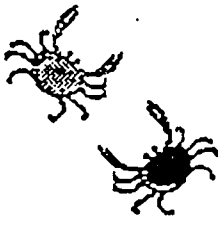
MILLIPEDES AND CENTIPEDES

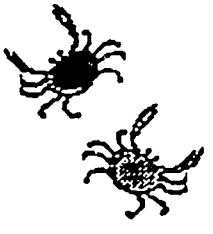
HOME CARD

CRUSTACEANS



ANOTHER GROUP OF ARTHROPODS IS CALLED CRUSTACEANS. SHRIMPS, LOBSTERS, AND CRAYFISH BELONG TO THIS GROUP. ALMOST ALL CREATURES IN THIS GROUP LIVE IN WATER. SOME LIVE IN THE OCEAN. OTHERS LIVE IN FRESH WATER. CRUSTACEANS HAVE FIVE PAIR OF LEGS AND AN EXOSKELETON DIVIDED INTO TWO PARTS. CRUSTACEANS MOVE BY MUSCLES ATTACHED TO THEIR EXOSKELETON.





MILLIPEDES AND CENTIPEDES

MILLIPEDES AND CENTIPEDES IS ONE GROUP OF ARTHROPODS. THEY ARE WORMLIKE CREATURES WITH MANY LEGS. THE DIFFERENCE BETWEEN A MILLIPEDE AND A CENTIPEDE IS THAT A MILLIPEDE HAS TWO PAIRS OF LEGS PER BODY SEGMENT. A CENTIPEDE HAS ONLY ONE PAIR OF LEGS PER BODY SEGMENT. A MILLIPEDE IS AN ANIMAL THAT IS HARMLESS AND EATS PLANTS. A CENTIPEDE EATS OTHER ANIMALS. IT USES A PAIR OF POISONOUS CLAWS NEAR ITS MOUTH TO CAPTURE ITS FOOD.

CARD

INSECTS

THERE ARE MORE DIFFERENT KINDS OF INSECTS THEN ANY OTHER FAMILY. AN INSECT HAS SIX LEGS AND THREE SEGMENTS. THE SEGMENTS ARE THE HEAD, THE THORAX, AND THE ABDOMEN. MOST INSECTS HAVE COMPOUND EYES. THESE EYES HAVE MANY LENSES. THE INSECT CAN THEN SEE MOTION. INSECTS HAVE TWO FEELERS. THESE ARE CALLED ANTENNAE. THEY HELP THE INSECT FEEL AND SMELL. THEY ARE ALSO USED FOR TASTING AND HEARING. AN INSECTS BODY IS COVERED WITH AN EXOSKELETON. SOON, IT GETS TOO SMALL AND THE INSECT MOST MOLT. TO MOLT MEANS TO SHED THE HARD OUTER COVERING.

SPIDERS,TICKS, AND MITES

SPIDERS, TICKS AND MITES ARE ANOTHER GROUP OF ARTHROPODS. THE ANIMALS IN THIS GROUP HAVE FOUR PAIRS OF LEGS AND TWO MAIN BODY PARTS. SOME OF THE ANIMALS IN THIS GROUP CAN HELP US BY KILLING OTHER ANIMALS. AN EXAMPLE OF THIS IS A SPIDER. SPIDERS CAN ALSO BE HARMFUL TO US LIKE THE BLACK WIDOW. SOME OF THE ANIMALS IN THIS GROUP CAN BE PESTS TO US LIKE TICKS AND MITES. THEY GET ONTO YOUR BODY AND SUCK THE BLOOD OUT OF THAT AREA.

CARD 4

STUDENTS CREATE INVENTIONS

Topic:	**Science**
Grade Level:	**Grade Four**
School:	**Avery Elementary, Hilliard City Schools**
Partner:	**Bischoff & Associates**

Summary of Activity:

The students met in groups to discuss problems that could be solved with the creation of a new invention. They were then to try to create the new invention. The students were given three weeks of class time to work on their inventions. One partner worked directly with students in the classroom and other partners at the company worked with the students by having the students fax diagrams to them to be evaluated and offered recommendations. The students were assessed by the teacher, peers, and business partner for three parts of their project. These parts included the invention, a labeled diagram of their invention, and a presentation. The teacher graded the fourth part which was a written report. This project was a great way to get students to think creatively!

Learning Outcome:

To help children discover that most inventions are created as a result of a problem or need.

Assessment Information:

Methods:	• Long-term project evaluated by the teacher, business partner, student (self-evaluation), and peers using a scoring rubric
Purpose of Assessment:	• Teacher use for monitoring progress
Social Structure:	• Individual and small group
Time:	• Thirty minutes per day for 2-3 weeks
Materials:	• Inventor's log • Scoring Rubric • Students provide their own materials for their inventions
Instructions to Students:	To begin the activity, challenge students by introducing this idea: In order to create an invention that is really needed you will have to find a problem to solve.

Working in pairs, have students interview one another to find out what they have that doesn't work the way it should or what their biggest problem is. Each pair of students should take turns interviewing and recording.

Ask students to return to their group and share problems. Then have each table share with the entire class.

Assignment: Students will complete an invention project. Share with them that one of the best ways to come up with a winning invention is to select one that seems to be the most interesting and is needed. Challenge students to use their imagination and creativity.

There are three parts to the invention project.
(1) The invention itself
(2) A labeled diagram of their invention
(3) A presentation and written report explaining how they decided on the invention, how it works, and any difficulties they had.

The Inventor's Log can help them brainstorm ideas as they progress through the inventing process. The teacher and business partner provide individual guidance and feedback to students as they conceptualize and design their invention. Because students had developed the scoring rubric at the beginning of the project, the teacher and partner frequently remind the students about the rubric as they work with them.

On the day of the presentation, give each student a class list and make sure they have a copy of the Scoring Rubric to score each student. Explain how the scoring should be done. Perhaps doing an example for a fictitious student would be helpful. The teacher and partner should also score each presentation using the rubric.

After the presentations, have students write reflections. Ask them to write what they enjoyed about doing their invention, difficulties they had and what they thought about the business partner's role.

Extension: Plan a Toy Day for the week before the December holidays. Tell the students to bring a toy to school that has a moving part. Ask them to draw a diagram of how they think the toy works. The toys and

diagrams are shared orally with fellow students, the teacher, and business partner. The business partner gives additional comments on how the toys work.

Scoring:

Criteria:

Scoring Rubric: Student presentations were judged by peers, teacher, business partner and themselves on the various criteria using the following scale

Scale:

3 =	Outstanding! Deserving of an Award!
2 =	A good job. With a little more thought/work/practice would be outstanding.
1 =	Okay, not great, but okay
N.Y. =	Not yet
0 =	Not completed

Criteria were

•	Invention:	(a) Was it useful? (b) Was it well constructed?
•	Diagram:	(a) Neatly drawn? (b) Labels?
•	Presentation:	(a) Spoke clearly and slowly? (b) Well organized?
•	Report:	(a) Good information? (b) Neatly drawn?

Criteria Development:

Criteria were developed by students through extensive brainstorming.

Issues and Implications:

Criteria for Scoring:

Students had difficulty remembering how they would be scored on their project. To solve this a copy of the rubric was given each student.

Related to this, students had difficulty knowing what information to include on their invention diagram. To aid them with this step each student drew a diagram and it was faxed to our business partner. He and his colleagues evaluated each and brought them to class on a day we were working on inventions. He discussed the diagram with each student and recommended changes while the teacher worked with small groups on their written reports.

Business Partner Involvement: The invention project was enhanced by the involvement of the business partner. Planning sessions were scheduled with the business partner every other Monday after school. This enabled him to keep up to date on the progress of the students' work and to plan for the time he was in the classroom while the students were working on the different phases of the invention. The students valued his recommendations and coaching.

Impact:

For the student. Since the rubric (scoring method) was developed by the students, it helped them accept ownership of the assessment of their project. It also helped the students be more motivated.

For the teacher. The teacher's role as coach giving guidance made it possible to work with individual students more frequently.

For the business partner. Being involved with the students as they worked on their project was easier knowing how they were to be assessed.

For the parent. By having a copy of the assessment tool (rubric) the parents were able to help their child with ideas and materials.

STUDENTS CREATE INVENTIONS

Submitted by:

Ellen Stinemetz
Avery Elementary
Hilliard City Schools

John Thomas
Bischoff & Associates

INVENTOR'S LOG

Name_____ Date_____

1. Invention Name_____

Materials needed:

Drawing (label parts):

Comments:

2. Invention name_____ Date_____

Materials needed:

Drawing (label parts):

Comments:

INVENTION RUBRIC

Student Name _____

Peer Evaluator _____

	Self 1, 2, 3 n.y. 0	Peer 1, 2, 3 n.y. 0	Teacher 1, 2, 3 n.y. 0	Bus. Part. 1, 2, 3 n.y. 0
1. Invention a. Useful?				
b. Well Constructed?				
2. Diagram a. Neatly Drawn?				
b. Labels?				
3. Presentation a. Spoke clearly and slowly?				
b. Well organized?				
4. Report a. Good Information?	XXXXXXX XXXXXXX XXXXXXX	XXXXXXX XXXXXXX XXXXXXX		XXXXXXX XXXXXXX XXXXXXX
b. Neatly Written?	XXXXXXX XXXXXXX	XXXXXXX XXXXXXX		XXXXXXX XXXXXXX

Key: **n.y. = not yet**
0 = not completed
1 = Okay, not great, but okay
2 = A good job. With a little more thoughts/work/practice would be outstanding.
3 = Outstanding! Deserving of an Award!

DESIGNING A METEOROLOGICAL RECORDING SHEET

Topic:	Science
Grade Level:	Grade Four
School:	French Run Elementary, Reynoldsburg City Schools
Partner:	AT&T

Summary of Activity:

With the help of the partners from AT&T, the students learned to use weather instruments such as barometers, hygrometers, anemometers, and thermometers. They also learned how a cloud is formed and the different types of cloud formations. The students were to show an understanding of several meteorological observation techniques and tools by means of a Meteorology Observation Sheet. These Meteorology Observation Sheets were then evaluated by peer evaluations. The students constructed their own scoring criteria for assessing the Meteorology Observation Sheets. After scoring these forms, they were given an opportunity to choose the observation sheet they wanted to use for recording future meteorology observations. Students were also invited by their partners to visit AT&T in order to see them in their laboratory setting.

Learning Outcome:

To demonstrate understanding of meteorological observation techniques and tools.

Assessment Information:

Methods:
- Short term project judged through peer evaluations

Purposes of Assessment:
- Teacher use for assignment of grades
- Student use for self-reflection on work
- For use in parent conferences

Social Structure:
- Large group (entire class)
- Individually
- Small groups

Time:
- One 30-minute session for development of the scoring criteria
- One 30-minute session for development of the meteorology observation sheets
- One 90-minute session for the peer evaluation

Materials:

- Pencils and rulers
- Unlined paper
- Students' class notes (optional)

Instructions to Students:

Prior to beginning this activity, the students will have received instruction on meteorological terms, concepts, and use of meteorological instruments. In this instance, instruction was provided by the teacher as well as the business partners who are scientists and engineers with a major communications corporation.

Following this, the teacher might introduce the activity by saying, "Tomorrow you will each be developing a Meteorology Observation Sheet that will be used throughout the year to record weather observations. You will all be taking part in the grading of this observation sheet. As a class we will decide the grading criteria and then, in small groups, we will grade the sheets." The class should then spend time determining the criteria by thinking about the important aspects of observation forms.

In preparation for the next day's activity (i.e., development of the observation sheet), the students are asked to think about how they want to develop their own observation sheet. They will be allowed to use class notes and other resource information, and may wish to practice this task by making a practice observation sheet at home that evening.

The next day, the children are given a sheet of unlined paper to use in developing their own Meteorology Observation Sheet. They are instructed not to put their names on their sheets. To ensure anonymity during the peer evaluations, students choose a "secret number," write their name and the number on a "post-it" note, and attach the note to their Meteorology Observation Sheet. The teacher will keep a record of names and "secret numbers."

After the students have completed developing their observation sheets, a 60-90 minute session is devoted to the peer evaluations of observation sheets. To do this, the class is divided into groups and each group is given several Meteorology Observation Sheets. Each group

scores one sheet at a time using the criteria established by the class.

Scoring:

Criteria:

- Observation Sheet Scoring Checklist (overall total 38 possible points)
  - a. Title (total 6 points possible)
    - Was the title, "Observation Sheet," given? (1 point)
    - Was the title underlined? (1 point)
    - Was the title capitalized properly? (2 points)
    - Was the title spelled properly? (2 points)
  - b. Items (total 27 points possible).
    Were the following items included and spelled properly? (2 points for including the item and 1 point for spelling it correctly)
    - Time
    - Date
    - Barometer reading
    - Cloud forms
    - Illustration of cloud forms
    - Temperature
    - Wind direction
    - Precipitation
    - Hygrometer reading
  - c. Overall Appearance (total 5 possible points)
    Consider adequacy of:
    - straight lines
    - spacing
    - neat handwriting

These points could be converted into letter grades.

Criteria Development: As a class, students developed the scoring criteria and their associated point values.

Equity Issues: To ensure anonymity, "secret numbers" were used. The teacher later checked each sheet after it was graded to make sure there were no grading errors.

Issues and Implications:

Grading Errors: There were few grading errors made. In the instances where this occurred, though, the teacher returned the observation and scoring sheets back to the group for them to look at it a second time, and the group made corrections in the scoring. This did, however, result in more time spent on the grading activity than was anticipated.

Impact:

Valuable feedback and active student participation. This activity provided valuable feedback for the teacher and business partners regarding the ability of students to complete follow-up work related to the meteorology lessons. It also gave students an opportunity to take an active role in determining the scoring criteria and evaluating their assignment.

Improved quality of work. After scoring was completed, each student was given an opportunity to choose the observation sheet he/she wanted to use for recording future meteorology observations. (Some chose their own; others chose a peer's.) The teacher then duplicated them so that each student had enough to use for the remainder of the year. As a result, students took note that most of the Meteorology Observation Sheets chosen were those having quality appearances. They have since strived to hand in quality work.

DESIGNING A METEOROLOGICAL RECORDING SHEET

Submitted by:

Cindy Morehart
French Run Elementary School
Reynoldsburg City Schools

Sharren Rathburn
AT&T Business Partners