UNIVERSITY PRIMARY SCHOOL
2002 NAGC Curriculum Competition

Expanding Our Horizons: Investigating Music & Measurement

A Report on Two Projects

University Primary School.
Department of Special Education. University of Illinois at Urbana-Champaign.

Site Designed by Jeff Goelitz

Expanding Our Horizons: Investigating Music & Measurement

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Expanding Our Horizons: Investigating Music & Measurement

Introduction

Welcome to the University Primary School on-line curriculum entitled, *Expanding Our Horizons - Investigating Music and Measurement.* The curriculum is a report on two project investigations undertaken by our preschool and K/1 students: *Studying Music* and *Who Measures What in Our Neighborhood.* We invite you to peruse the website to see and hear the content that students "uncovered" in their investigations. We are excited to be including digital video clips and an extended "Video Gallery" for each project story. The video segments allow you to listen to visiting experts, see students on their field experiences, and observe class activities that demonstrate how teachers facilitate inquiry.

Highlights of *Studying Music* include field experiences that take 3 and 4 year olds to a piano store where they discover how the keys on the piano make sound. In the video clips, hear the pipe organ, and watch students conduct their own percussion ensembles. Throughout this project, preschoolers are introduced to a variety of instruments and music from around the world.

Students explored numerous fields of study to find out how and what people measure in *Who Measures What in Our Neighborhood*. Highlights include video segments of students' field experiences and links to download students' PowerPoint presentations where they reflected and communicated what they had learned about measurement. Students' reflections demonstrated in-depth understandings of what is often complex and abstract for 5 and 6 year olds. Included in this project story are five student portfolios that reveal students' growth over the five-month project.

A special feature of the curriculum is an alignment of the preschool project activities with the NAEYC accreditation curriculum component and the K/1 project activities with the Illinois Learning Standards. This allows readers to see that project-based learning is not an addition or an add-on to the basic skills curriculum, but it is the context through which basic skills are taught and mastered.

Through these project narratives, the readers will follow the process of inquiry, see examples of students' work, gain insight into the students' thinking, and examine how the teachers reflect upon the students' newly gained knowledge, skills, and dispositions. Students had numerous opportunities to work at their own level, in their own interest areas, and in their preferred learning styles. They were also challenged to move beyond their comfort zones, gain new levels of awareness, develop richer vocabulary, support their opinions, and problem-solve to accomplish their individual and group goals.

We hope you enjoy the tour of the project investigations. We invite you to peruse the website or download a printable version of the whole document!

University Primary School

University Primary School (UPS) is an early childhood gifted education program affiliated with the Department of Special Education at the University of Illinois. There are currently two multi-age classrooms, one preschool room with 3/4 year olds and one K/1 classroom with 5/6 year olds. The classrooms each have 25 students and are staffed with a head teacher and graduate assistants. The mission of UPS is to provide a site for the College of Education to demonstrate, observe, study, and teach best practices in early childhood and gifted education. In this way, UPS is a site for research and teacher education, while at the same time providing a service to the community, especially to families with young children. Each year the school hosts local, national, and international visitors.

Enrollment is open to all children in the community. The children at University Primary School are culturally and linguistically diverse. Two-thirds of the students' parents have some affiliation with the University of Illinois either as faculty, students, or staff. The student population includes students with special needs.

At University Primary School the teachers use the Project-Approach to design emergent curriculum (Katz & Chard, 2000). The distinguishing feature of the approach is that very young children are engaged in investigation. Each investigation is an opportunity for students to pursue their own questions. The National Academy of Sciences distinguishes between full and partial inquiry and defines full inquiry as opportunities for students to pursue their own questions (2000, p. 28). Inquiry promotes children's natural curiosities and develops environments where children are intrinsically motivated to learn. "An emphasis on inquiry asks that we think about what we know, why we know, and how we have come to know" (National Academy of Sciences, 2000, p. 6).

To facilitate project investigations, the daily schedule includes time for individual and small group investigations. This time period is called Project/Activity Time. This is an extended time period (approximately one hour) where students make choices about their own learning. Teachers facilitate small group work related to project investigations while other students work independently or in groups on self-selected activities. Project/Activity Time strives to foster "the love of learning" and provides an opportunity for teachers to engage in the learning process with their students. For more information about the school, please refer to the UPS Home Page.

References

Katz, L. & Chard, S. (2000). Engaging children's minds: The project approach (2nd ed.). Norwood, NJ: Ablex Publishing Corp.

National Research Council (2000). Inquiry and the national science education standards. A guide for teaching and learning. Washington, D.C.: National Academy of Sciences.

Expanding Our Horizons: Investigating Music & Measurement

University Primary School
Typical Daily Schedule
Preschool Classroom

8:30 – 8:40	Arrival and Greetings
8:40 – 9:40	Project/Activity Time Open Snack
9:40 – 10:00	Large Group Meeting Songs Debriefing of Project/Activity Time Activities Introduce New Topics Related To Projects
10:00 – 10:45	Outside Play
10:45 – 11:00	Large Group Meeting Shared Literature
11:00 – 11:45	Project/Activity Time Teachers Facilitate Independent Or Small Group Investigations Literature Extension Activities Numeration And Problem Solving Activities Integrated Into Project Topic
11:45 – 11:55	Large Group Meeting Debriefing of Project/Activity Time Activities Review Day's Activities Prepare to Go Home
12:00 PM	Dismiss

University Primary School
Typical Daily Schedule
K/1 Classroom

8:30 – 8:40	Arrival and Greetings
8:40 – 9:00	Journal Writing
9:00 – 10:15	Project/Activity Time Open Snack
10:15 – 10:25	Large Group Meeting Songs Debriefing of Project/Activity Time Activities Introduce New Topics Related To Projects
10:25 – 10:45	Outside Play
10:45 – 11:30	Language Block Large Group Meeting Shared Literature and Discussion Small Group Instruction – Literacy (Writing, Language, Reading, Spelling)
11:30 – 12:00	Lunch
12:00 – 12:30	Outside Play
12:30 – 1:00	Quiet Independent Reading Teachers Hold Individual Reading Conferences
1:00 – 1:25	Shared Literature
1:25 – 2:00	Small Group Math Instruction
2:00 – 2:25	Project/Activity Time
2:25- 2:30	Clean-Up Whole Group Meeting – Debriefing Project/Activity Time Activities
2:30 PM	Dismissal

Expanding Our Horizons: Investigating Music & Measurement

The Project Approach

The Project Approach shares common features of curriculum design with what are considered effective practices in gifted education:

- Emphasis on challenging and intellectually engaging material.
- Role of teacher as facilitator of learning.
- Attention to students' interests and learning styles.
- Means of exhibiting strengths and talents of individuals.
- Introduction to inquiry in various fields of study (e.g., acting as young investigators in a particular field).
- Assumed high expectations and capability of students.
- Authentic learning and "real audiences."

For more information about the Project Approach, see the following:

The Project Approach — Dr. Lilian G. Katz, University of Illinois

Project Approach Home Page — Dr. Sylvia Chard, University of Alberta

Issues in Selecting Topics for Projects — Lilian G. Katz and Sylvia C. Chard

ERIC/EECE Digests on topics related to the Project Approach

- Another look at what young children should be learning
- The Benefits of Mixed-Age Grouping
- Child-Initiated Learning Activities for Young Children Living in Poverty
- The Contribution of Documentation to the Quality of Early Childhood Education
- A Developmental Approach to Assessment of Young Children
- Developmentally Appropriate Practice: What Does Research Tell Us?
- Encouraging Creativity in Early Childhood Classrooms
- Integrate, Don't Isolate--Computers in the Early Childhood Classroom
- Problem Solving in Early Childhood Classrooms
- Reggio Emilia: Some Lessons for U.S. Educators
- Resource Rooms for Children: An Innovative Curricular Tool
- Teaching Young Children about Native Americans

Expanding Our Horizons: Investigating Music & Measurement

Dissemination

.ppt	Challenging Mathematics: Data Collection in Kindergarten
.ppt	Let's Talk: Facilitating Thinking Through Group Discussions
.ppt	Opportunities to Respond: The Literacy Rich Environment
.html	General Learning Activities for Project Investigations Step by Step Planning Calendar
.ppt	Challenging Young Learners Using the Project Approach
.ppt	Young Investigators and Problem Solving

Related Links

Inquiry Based Learning - Bertram Bruce, Professor, University of Illinois
http://inquiry.uiuc.edu/

National Association for the Education of Young Children (NAEYC)
http://www.naeyc.org/

National Association for Gifted Children (NAGC)
http://www.nagc.org

ERIC Clearinghouse on Elementary and Early Childhood Education
http://ericeece.org

ERIC Clearinghouse on Disabilities and Gifted Education
http://ericec.org

Expanding Our Horizons: Investigating Music & Measurement

General Learning Activities for Project Investigations

Phase 1

1 **Opening Event** Share a personal story, read a book, share a class experience to begin discussion of project topic with children.	2 **Brainstorm Ideas** Children list ideas from life experiences that relate to topic as the teacher writes. Begin a topic web.	3 **Categorize Ideas** Revisit with children to form categories of similar ideas. Share project topic with parents.	4 **Label Categories** Children debate best name of categories. Children develop Topic Web I.	5 **Share Personal Stories** Group Meeting: Share students' personal experiences with the project topic.
6 **Illustrate Stories** Children draw, write, dictate, or dramatize to represent and share their prior experiences.	7 **Share Stories** Children share their representations of stories, noting similarities or differences.	8 **Collect Data** Develop surveys to find out what classmates already think they know and understand about the topic.	9 **Represent Findings** Children represent their findings using math and science organizers.	10 **Articulate Questions** The teacher and the children voice their "wonderings" about the topic. Children dictate questions that they would like to answer about the topic.

Phase 2

11 **Group Planning** In discussion, children think about what to do, where to go, who to ask to find answers to their questions.	12 **Make Predictions** Before doing field work (site visits, experiments, observations, etc.) children predict (draw or dictate) what they might see or collect during field work.	13 **Engage in Field Work*** Children collect data to answer questions. (e.g. drawing, asking experts questions, collecting artifacts, counting, and taking pictures) ***This may take weeks!**	14 **Debrief** Children share experiences and compare findings with predictions.	15 **Create Representations** Children represent their findings using a variety of means such as drawings, writings, constructions, paintings, and/or math and science organizers.
16 **Share** Progress on representations is shared with classmates offering suggestions.	17 **Plans for Visiting Expert** Children decide interview questions. Teacher charts predictions of the answers.	18 **Expert Visitor** Children ask questions and make drawings of answers or any artifacts.	19 **Debrief** Children compare experts' answers to their predictions.	20 **Continue Investigation** Additional days may be needed to continue to investigate. Additional experts, field-site visits and/or same site may be revisited.

Phase 3

21 Representations Sharing representations continues. Encourage a variety of medium including, dramatic play, music, plays, & invented games.	**22 Articulate What Children Have Learned** Group Discussion: What have they learned about the topic.	**23 Brainstorm Second Topic Web** Children list ideas of "what they now know" about the topic. Begin to develop Topic Web II.	**24 Label and Categorize Ideas** Children form categories of similar findings, understandings, and ideas. Children debate and name the categories. Children complete their Topic Web II.	**25 Plan for Sharing** Plan the culminating event and make invitations for the chosen audience.
26 Project Highlights Each child prepares to share the story of the learning achieved by the class by using posters, reports, plays, museum format, explanations, songs, and/or videos, etc. They may choose to work individually, in a small group or prepare a whole class presentation.	**27 Imaginative Activity** Children may engage in more expressive activities using their new understanding in poetry, stories, pretend drawings, etc. Progress on their display is shared with classmates.	**28 Display** Children contribute to the class display. Work from all the phases is displayed to show the children's growth in understanding.	**29 Culmination** Parents, and other students visit to view the displays and hear children share what they have learned about the project.	**30 Evaluation** Children, parents and teachers reflect on the project.

Studying Music

Preschool Classroom

Table of Contents

Studying Music

Preschool Classroom

Project Objectives

There are two different types of objectives articulated and identified in this project entitled, *Studying Music*. General objectives for project-investigations are common across all topics. They are aligned with best practices and high quality curriculum as described by the National Association of the Education of Young Children and the National Association for the Gifted. General objectives reflect the process of inquiry and the students' engagement in in-depth studies.

Specific content objectives for each project investigation emerge initially out of topic webs and are formulated and reformulated by the students' questions, the teachers' guidance, and the shifting interests of the students as the project progresses. The degree to which a child experiences depth and complexity of a topic may be different depending upon the diversity of skills and abilities of the students. Not all children master each objective, but respond to the tasks and progress at their own level. Outcomes are varied and children demonstrate different levels of content and skill mastery.

General Objectives for Project Investigations

1. Students will engage in an in-depth study of a topic.
2. Students will pursue first hand investigations.
    - Students will engage actively in data collection.
    - Students will become more proficient in organizing data.
    - Students will learn and utilize different modes for representing data.
3. Students will think critically and reflectively.
    - Students will engage actively in discussions of the topic, exchange ideas, debate, etc.
    - Students will formulate questions.
- Students will evaluate their experiences in many ways and participate in culminating activities.
4. Students will relive and renew experiences they have had with various subject domains.
5. Students will increase their ability to use primary and secondary resources.
6. Students will increase their vocabulary.
7. Students will learn and apply new modes of inquiry including questioning and hypothesizing, reforming of hypotheses, interviewing, surveying, and observing.
8. Students will increase their modes of representing their ideas (observational drawings, graphs, Venn diagrams, displays).
9. Students will uncover facts and principles in various subject domains.

10. Students will be exposed to numerous and varied instructional strategies such as the following:
    - Whole group instruction and discussion
    - Small group instruction and discussion
    - Interviews with experts
    - Field trips
    - Field studies
    - Student-initiated projects such as constructions, surveys, representations
    - Personal conversations with teachers or other student experts
    - Experimentation
11. Students will strengthen their dispositions to be interested in relevant and worthwhile phenomena.

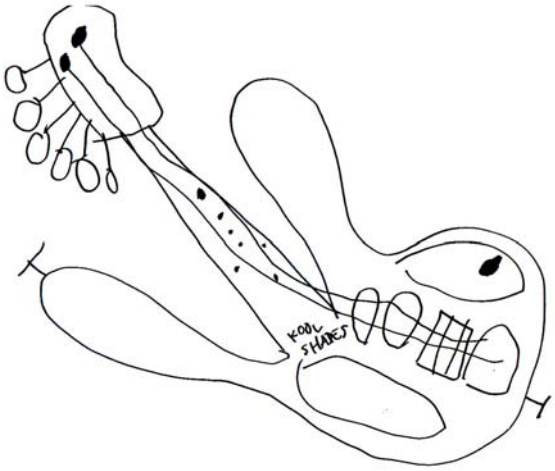
Specific Content Objectives for *Studying Music*

1. Students will gain an appreciation for many types of music.
2. Students will learn about a variety of instruments.
3. Students will learn which instruments are in an orchestra.
4. Students will increase their understanding about rhythm and movement.
5. Students will gain an awareness of instruments played in our community.

Studying Music

Preschool Classroom
January – May 2002

Overview



Beginning the Project

Music is part of our every day lives. Music also plays an integral role in early childhood education to give young students shared happy and positive experiences. As the University Primary School year opened, many guests shared and played instruments for the students. Some students were taking music lessons and brought in their instruments to play and share with the other children. Parents and other adults brought a variety of instruments to share and play at large group meeting time. Teachers purposefully and routinely integrate musical activities into all of the project investigations throughout the year. They also teach students a variety of songs from different countries and invite the families to share the richness of the cultures that are represented in the diverse group of students. The teaching assistant from Korea taught students songs in Korean. Some parents suggested to the teaching staff that music might be an engaging topic for further exploration.

The teachers agreed that the topic of music was broad enough to provide opportunities for students to explore their own interests and the investigation began. The teachers at a team planning meeting created a music topic web with all of their ideas about possibilities for study.

During the first phase of the project, teachers wanted to know more about what the students already understood about music. The teachers shared their personal stories of going to the symphony, attending the ballet and going to recitals. The children took turns sharing stories about their experiences with music. During large group meetings, students brainstormed what they knew about music to create the Student Music Topic Web 1. The teachers questioned students about all aspects of music: what types of instruments they knew, where they hear music, how they play it, and where they would like to go to expand their knowledge about music.

The teachers provided opportunities for students to make three-dimensional representations of instruments. Children used plasticine, coated wire, and play dough to create their representations from memories. Students began to ask questions at large group meetings. The teacher placed their questions on the wall for further exploration.

The teaching assistant plays her flute for the students at group time.

CB is sharing his Autoharp representation made out of boxes and junk during project/activity time.

Developing the Project

Teachers took the lead from their questions and categorized them to form study groups. In this way, the students explored different but related areas of music:

1. What is the relationship between music and movement?
2. What instruments make up an orchestra?
3. How are musical videos and songs produced?
4. What is the relationship between sound and music?
5. What is rhythm?

The teacher and her assistants organized field trips to help the students find the answers to their questions. Students collected data in many ways. Students made observational sketches to collect data on their field site tours. They interviewed invited guest speakers, made observational drawings of collections of instruments at school, took photographs to document their experiences, and videotaped some of their field trips.

Back in the classroom, daily choices during project/activity time included many music related experiences. The teacher put musical tapes with books in the listening center. Students brought in favorite CD's to share with others. Students wrote their own music using the colored hand bells and musical staff paper. They created instruments from boxes and junk in the art area. Some students formulated surveys about what instruments other students had in their homes. Teachers taught them how to tally and analyze their results. They watched videos about an orchestra since they did not have access to an orchestra playing during school hours. The videos were informative and spurred even further questions. Their data collection and group discussions contributed to new understandings about music and expanded their knowledge base.

The piano expert strikes the keys to demonstrate how the piano makes sound.

The maestro is teaching the preschool boys how to conduct in three beat measures.

Concluding The Project

To conclude the music project, the teachers and students invited parents, family and friends to hear the classroom orchestra, watch the interpretive ribbon dance, listen to the group sing a variety of songs, and most importantly read the display on the walls to see the story of how students studied about music.

One group created a mural of orchestra instruments on acetate to hang in the window. The students invited all of their guests to try the pipe organ that they created from boxes and PVC pipe. The teachers created a questionnaire for parents to help them understand how much knowledge about music carried over to the home. The staff was curious to know if students used new vocabulary or discussed musical experiences with their families.

During the culminating activity, EM is conducting the orchestra.

The project display wall for parents at the culminating celebration.

What did the children learn?

The children became familiar with the names and sounds of various instruments. They increased their vocabulary and developed clearer understandings of the various parts of the instruments. They reported, “All instruments make sound.” Their observational drawings became more

detailed as the children looked closely for the various parts of an instrument. One group created a musical video for the whole class and demonstrated their knowledge about making a video.

Students had opportunities to associate music with feelings and moods. The students experienced vibration and learned how sound traveled. They applied knowledge of rhythm and improved their skills of echoing and following specific rhythms or beats. They also distinguished between high and low notes. They produced their own scores, composed their own music, and conducted it for the group. The students not only answered many of their original questions, but they became aware of instruments from other countries and found new ways to enjoy music in their world.

During project/activity time, a small group of students play music together.

GR and LB play the music they composed during project/activity time.

Studying Music

Preschool Classroom

Phase 1

Students share instruments and music.

The head teacher and her two graduate assistants enthusiastically brainstormed their ideas about music before initiating the project investigation. The teachers' music topic web included ideas related to instruments, students making their own music, guest speakers who played instruments, music from around the world, and many other areas for possible investigations.

The teachers wanted to know what the students already understood about music. Students began exploring the topic by creating a web of knowledge (Student Music Topic Web 1). The teachers reviewed the students' web for similarities of ideas and experiences.

During a parent conference, one parent suggested a variety of ways that students could make music with their bodies. While creating the first student topic web, this parent's child mentioned several ways to make music with the body. Those included stomping, whistling and clapping. Students were also interested in the different ways that they listen to music such as a cassette, CD, radio, and television. They categorized those devices under listening. Their experiences also included trips to concerts or performances they had attended. These ideas were targeted as possible field trips.

For several weeks, students shared memory stories about music during large group meetings. Examples of their stories follow:

LB: One day I went to a symphony orchestra. My mom told me a spooky story. It was in Rochester. It was about Tchaikovsky. He just got old and died.

ME: Once in my neighborhood there was a music store. Pianos were there. My neighbors were singing songs on a piano at a music store.

CG: I got a guitar at my house in my closet.

WG: I don't remember but we have a guitar in the closet. We got everything-kid instruments. The music box has instruments. It has three guitars or eight guitars.

CG: I have a ukulele at home. It came to my home in the mail. I got a hula skirt. There's a flower for our hair.

NW: My uncle and aunt have a piano. It is really big. We used to play stuff on it. We play *Mary Little Lamb.* My uncle plays *London Bridge is Falling Down.*

IP: One time I have a book about Abiyoyo. I'll bring it to school.

The students enthusiastically brought all types of instruments and music to school to share with their peers.

CB blows his trumpet that he brought from home.

EC shares her glockenspiel that she brought from home.

One group of students wanted to find out where people listen to music. They also wanted to know what instruments other students had in their homes. To find out the answers to those questions, the teachers helped the students create a questionnaire. They asked the students what instruments they were curious to know if people had at home. Teachers listed the instruments as student brainstormed their ideas. Then the teachers asked the students to draw pictures as icons on the survey to represent those instruments so that they would remember them when they got home. Students took the survey home and asked parents to mark yes or no if they had the instrument at home.

RS student shares his "rock and roll" with the class.

Preschool students created survey and sent it home to all of their parents.

In Phase 1, students engaged in many activities designed to express their memories of experiences with music. During the activity/project time students chose to draw instruments from memory. Several had been to hear an orchestra. They created pictures detailing each instrument. Using tempera paint in the art area, children painted pictures of instruments. Some students cut pictures out of a magazine to show "things that made music." Children were eager to bring music from home to share with the other students.

Students listening to music during project/activity choice time.

Collage of "things that make music."

Teachers also created opportunities for students to have shared experiences with music. During the large group meeting, the teachers introduced students to rhythm patterns. They began by clapping a simple A B pattern. It progressed to include A, B, C and many body parts. Preschoolers could clap and tap on their bodies or the floor. They made use of every possible space. They extended their instrument of the body to rhythm sticks. Students created patterns and the group echoed their patterns with the rhythm sticks. Progressively students improved in their ability to mimic the patterns together.

Students drew many memory drawings of instruments. The teachers listened carefully for understandings or misunderstandings as they explained their drawings.

CC saw the drum at the parade. The drummer was playing with his hands.

"I played cello at home by myself."

The teachers added several different types of mediums to the art area. Students made flutes and drums out of play dough. They sculpted their memories out of colored wire and clay and enjoyed making drums, violins, and many different representations.

Representation of a harmonica.

Plasticine representation of a harp.

The teachers and students continued to discuss what they knew or had experienced with music. Discussion during large group included the following comments:

CC: You can make all kinds of music.
EG: There's music in a party.
CC: You don't hear music.
DS: Can we write music that's 1/8, double and single?
WG: They could be bongo drums.
MP: You can use your hands.

Teachers noticed that several children had misconceptions. Some students were confused about differences between keyboards and pianos. Other students called parts of the trumpet and keyboard "buttons." KM said that he thought a person could carry a piano on a bicycle. The

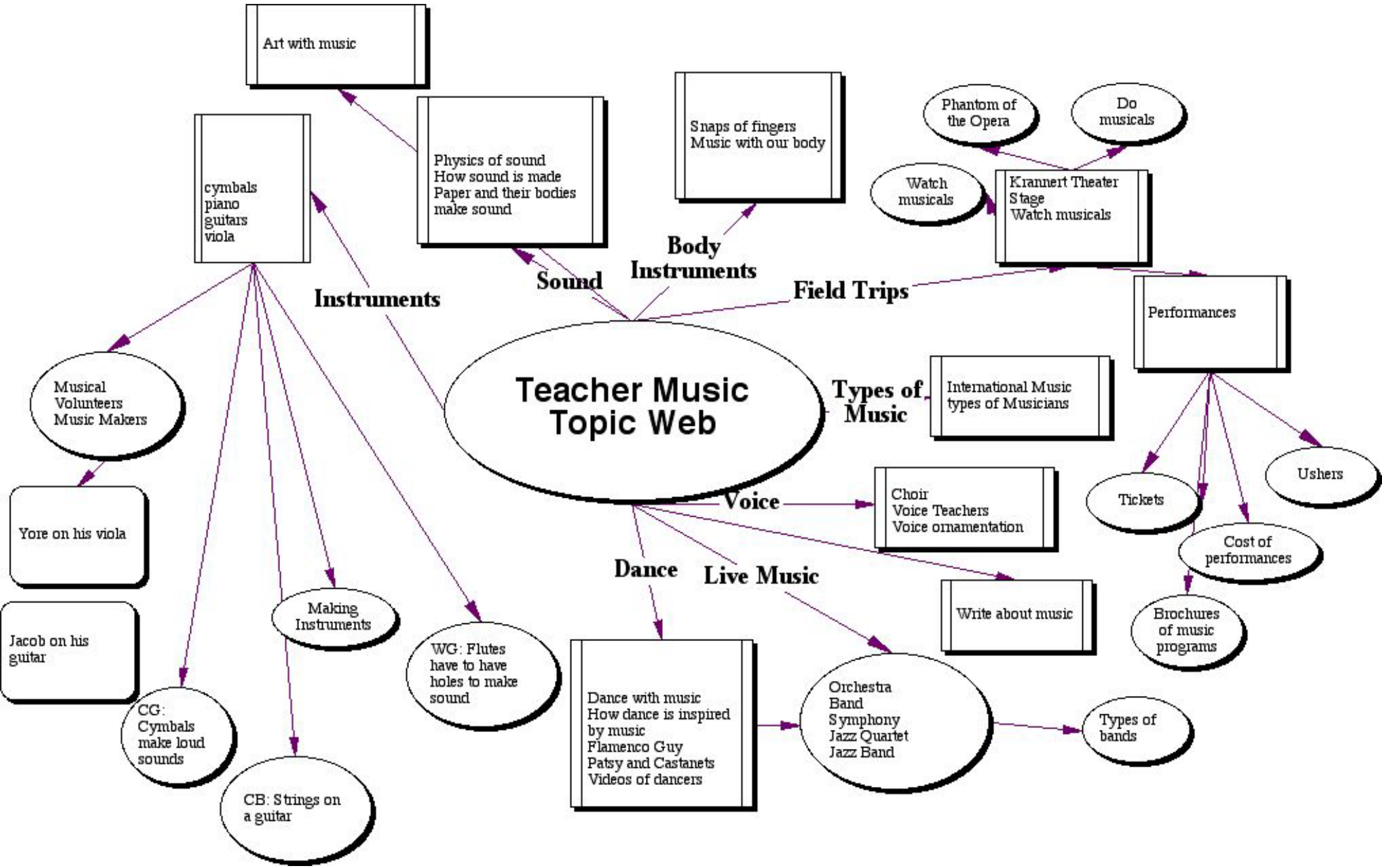
children wanted to find out more detailed information about the parts of instruments and the differences between them. They asked more specific questions during whole group meetings.

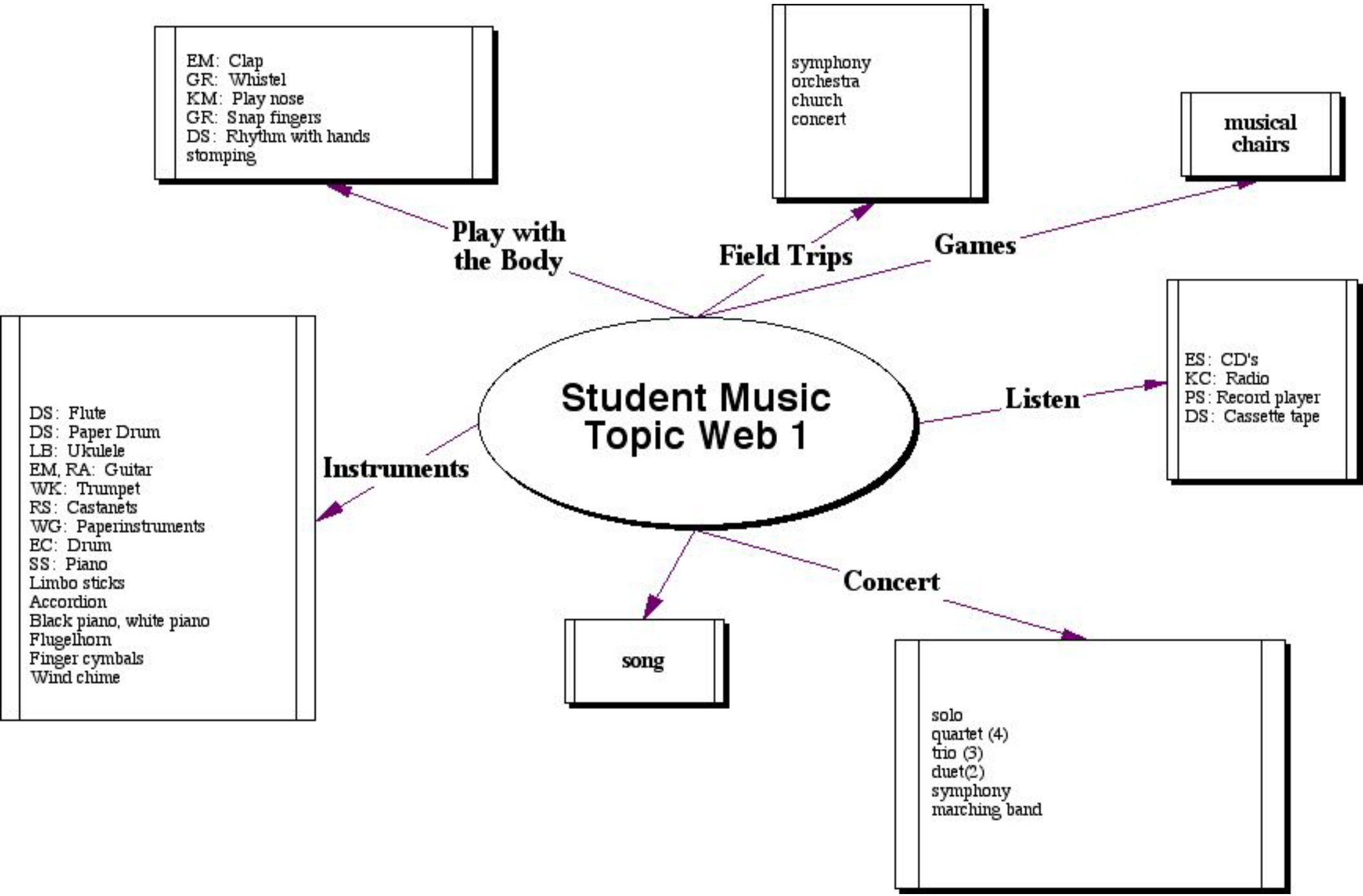
1. Why do cellos have sticks?
2. How do trumpets work?
3. How do tapes in a tape recorder work?
4. I want to know why a drum has sticks.
5. How does a piano work?
6. How does vibration make sound?
7. How do you blow a French horn?

During the teaching team planning times, the teachers discussed possible ways to find answers to the students' questions. In the weekly class newsletter, the teachers asked if parents had expertise in music. Parents responded eagerly and the class began the second phase of the music project.

Teachers concentrated on main areas for investigation based on the students' questions. The teachers guided large and small groups of students in their explorations. Some students investigated questions independently. Fieldwork in phase 2 focused on the following questions:

1. What is the relationship between music and movement?
2. What instruments make up an orchestra?
3. How are musical videos and songs produced?
4. What is the relationship between sound and music?
5. What is rhythm?


Teacher Music Topic Web
Art with music
Physics of sound
How sound is made
Paper and their bodies make sound
Snaps of fingers
Music with our body
cymbals
piano
guitars
viola
Instruments
Sound
Body Instruments
Phantom of the Opera
Do musicals
Watch musicals
Krannert Theater Stage
Watch musicals
Field Trips
Performances
Musical Volunteers
Music Makers
Yore on his viola
Jacob on his guitar
Making Instruments
CG: Cymbals make loud sounds
CB: Strings on a guitar
WG: Flutes have to have holes to make sound
Types of Music
International Music
types of Musicians
Voice
Choir
Voice Teachers
Voice ornamentation
Dance
Live Music
Dance with music
How dance is inspired by music
Flamenco Guy
Patsy and Castanets
Videos of dancers
Orchestra
Band
Symphony
Jazz Quartet
Jazz Band
Types of bands
Write about music
Tickets
Ushers
Cost of performances
Brochures of music programs


Student Music
Topic Web 1
Play with the Body
EM: Clap
GR: Whistel
KM: Play nose
GR: Snap fingers
DS: Rhythm with hands
stomping
Field Trips
symphony
orchestra
church
concert
Games
musical chairs
Listen
ES: CD's
KC: Radio
PS: Record player
DS: Cassette tape
Instruments
DS: Flute
DS: Paper Drum
LB: Ukulele
EM, RA: Guitar
WK: Trumpet
RS: Castanets
WG: Paperinstruments
EC: Drum
SS: Piano
Limbo sticks
Accordion
Black piano, white piano
Flugelhorn
Finger cymbals
Wind chime
song
Concert
solo
quartet (4)
trio (3)
duet(2)
symphony
marching band

Studying Music

Preschool Classroom

Phase 1 Photo Gallery

Memory drawing of playing in the orchestra.

SS sketches several favorite instruments.

Observational drawing of a flute.

EA makes a music choice during project/activity time.

Students create an observational sketch of MJ's violin.

Students share sounds and instruments at the large group meeting.

Studying Music

Preschool Classroom

Phase 2

Instruments, people, music and answers to our questions!

Students are introduced to the Jang-gu, a Korean drum.

NW plays a guitar he brought from home.

The students began Phase 2 by discussing ways to find answers to their questions. They decided that they needed to ask experts. During planning meetings the teachers discussed a variety of possibilities for guest speakers and field trips. The teachers and students found many different types of experts all over the twin cities. Some came to visit the classroom, and students met others during their field studies around the city. Students worked in both small and large groups to answer their questions that guided the direction of Phase 2.

1. What is the relationship between music and movement?
2. What instruments make up an orchestra?
3. How are musical videos and songs produced?
4. What is the relationship between sound and music?
5. What is rhythm?

What is the relationship between music and movement?

During the first few days, one group of students listened to music and drew what they felt. They used emotional words like happy and sad to describe the way they felt. They came back to report what they did during large group:

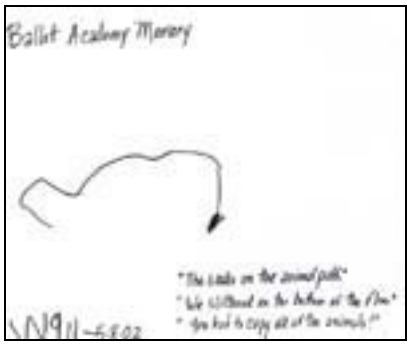
DS: We put on music and drew our feelings.
RS: We closed our eyes and drew.
KE: We drew how we felt when Patsy played the music.

Next, the students listened to *Carnival of the Animals* by Camille Saint Säenz. The teacher asked the students to think about what the music was representing. They guessed what animal was depicted through the music. Then the students moved their bodies to represent the animals in the music.

The students wanted to move to their own music. They created their own sounds and taped them on a tape recorder. The teacher shared students' compositions during a large group meeting for everyone to enjoy. Students made faces and body gestures to fit the music and further explored how different types of music made them feel.

The group studying movement visited a class at the Champaign-Urbana Ballet Academy. The students acted as various animals and moved across the room as they thought a rabbit or seal might do. The dance teacher asked them to be a snake on a path or a jumping bunny with their bodies. The students were butterflies, penguins, frogs, rams and turtles. They used all parts of their bodies to represent the animals. They reported back to the group by showing their various movements.

EC's memory drawing of the field trip to the Ballet Academy.



WG remembers "the snake on the animal path" at the Ballet Academy.

In the small group studying movement, the students reenacted a play of *Peter Pan* by using movement only. They mimed the actions, but used instruments in the background for special effects. This was an extension of an activity that they had done earlier in the year. After the local Junior Women's Club sponsored the *Peter Pan* play many students wanted to recreate it in the classroom. Several students wrote their own version of the play. They solicited actors, practiced during project/activity choice time and performed it for the whole class. After studying movement and music, the students found it challenging to perform the final production of *Peter Pan* without speaking. They tried to find movements to represent sword fighting, flying, and being a crocodile. The students used drums, shakers and tambourines to create the sound effects.

As a finale for studying the relationship between music and movement, the whole class participated in a ribbon dance. For several days, teachers placed ribbons, chopsticks and tape on the art table. Students explored using several colors of the wide ribbon. Some shredded the

ribbon into fine strips. Others used several colors and left them as wide strips. They practiced by going outside and listening to the teacher play the book drum. A sharp hit of the drum meant to prepare the ribbon by placing it on the ground. As the rhythm began, the students were free to move and express themselves. The teacher suggested moving the ribbons like a helicopter, slithering like a snake, using wide arm circles and going up and down. The teacher played several different musical excerpts while students waved their ribbons. Students noticed that there was a strong relationship between the music and the way it made them want to move their ribbons.

What instruments make up an orchestra?

To answer the question about instruments that make up an orchestra, the students explored many different types of instruments. They were especially interested in all of the instruments that other students had at home. Several families volunteered to share their instruments with the class. In addition, the teachers invited several local music experts to come into the class to answer the students' questions.

Harmonium, tabla, and ocarina

Parents of one student brought instruments from India. They were wedding gifts for the couple. The mother played the harmonium and the father beat on the tabla. Children enjoyed listening to the mother sing as she played her instrument that resembled a small organ mixed with an accordion. The father showed the children how to play in different areas of the drum top to create different sounds. He also blew into an ocarina.

Students learn about the Harmonium and the Tablas, handmade instruments from India.

KM plays the harmonium.

Hand Chimes

The hand chime expert shared a set of hand chimes that he uses in his church choir. The chimes were laid out in order on a heavy cloth. He demonstrated how to play the chime and how to

dampen its sound. He played a song for the group in dedication to his wife. As he played, he quickly put down one chime and picked up another one. Students saw how easily the chimes could get mixed up. The teacher explained that when people usually play chimes, they play in a group setting where each player uses only a few chimes. Every student had a chance to play a chime. When they held it and struck the chord, they could choose to dampen the chime on their bodies or on the heavy cloth.

Guitar

A librarian from Urbana brought her guitar and shared stories and songs with both classrooms. The students moved, swayed and danced to her songs. They counted the strings on her guitar and observed how she played the instrument. She told stories as she sang a song. Students brought in guitars they had at home. Their guitars varied in size from a small toy guitar to a standard size wooden guitar. One parent showed off both his rock and his folk guitars.

French Horn

The French horn expert brought two French horns to the class. He played them and the students observed the differences in the two. He talked about sound and how one can vibrate and manipulate sound to replicate instruments with some strange objects. He pulled out his garden hose and funnel. It sounded very similar to a French horn. He told the children it had been nicknamed the "French hose." He said, "The trick is to position the lip just right." The students asked the French horn player questions and EA found an answer to her original question, "How do you play a French horn?"

The French horn player blows his "French hose."

Student's memory drawing of the French hose.

Several older siblings from grade school visited to explain what they knew about instruments. One brother in second grade told the students "forte" meant loud sounds and "piano" meant soft sounds. One of the preschool students added that "mezzo" is a medium sound. The brother shared pictures from his piano practice book showing different pianos. A fourth grade brother of another student brought his cello back for a second concert. He had played once before for the

class during the fall. Now the students had questions about his cello and wanted answers. The teacher wrote their questions on chart paper before his visit. When he came to the class, he talked about the horsehair bow, cello strings, and the peg at the bottom of his cello, as well as his music stand and its purpose. After his explanations, he answered the students' questions. Other students generated more questions during the visit.

Students' Questions	Cellist's Responses
Where did you get the book? (SS)	At the Music Shoppe
Where did you get the cello? (AW)	At the Music Shoppe
Where did you get that (music stand)? (WG)	With the cello
Where did you get the bow? (EC)	With the cello.
Why is there a bend in the music stand? (DS)	To fold it up
Do you have sharps? (DS)	Yes, C# and F#
Why do you have color tape on your cello? (SS)	It shows me where to put my fingers down to play the notes.
How do you learn to play it? (KE)	My music teacher at school
What is that thing? (KM)	A rock stop. It keeps the cello from sliding on the floor.

Throughout Phase 2 students introduced their peers to various instruments that became available for students to explore during project/activity time. They made observational drawings, and compared their sizes, shapes and sounds. The instruments included the following:

autoharp
drum
floor keyboard
flute
glockenspiel
guitar
hand bells
homemade instruments
maracas
plastic trumpet
recorder
small keyboard
tambourine
toy saxophone
train whistle
triangle
viola
violin
wooden flutes
zither

Musical Groups – Percussion and String Quartet

Two ensembles of the Champaign-Urbana Symphony visited the school to play for both classrooms. The first was a percussion group. They were fantastic with the children. They not only played instruments made from common ordinary objects but they had a skit to intrigue the students. The instruments they used included balloons, spoons, garbage cans, egg shakers, wastebaskets, spoons, plus pots and pans. They involved the audience by allowing the students to have a part in one of four different rhythm sections.

The percussion ensemble divides the audience into four rhythm groups.

The second group that performed was a string quartet. Two violins, one viola and a cello made up the ensemble. As the group played a Vivaldi tune, the preschoolers recognized the song from *The Four Seasons* CD that DS shared with the class.

The Champaign-Urbana Symphony Guild String Quartet

A student drawing of Wendy playing the first violin.

Korean Drums

A Korean Drum group highlighted the music visits. Four drummers played Jang-gu drums. The sound, uplifting and loud, filled the room. Workers from offices nearby came to see who was performing. The drummers used both hands to hold drumsticks. One is held with the stick pointing down. The other is held with the stick pointing out, as one would play a big bass drum. The students had an opportunity to play the drums. Later in the project, an assistant teacher borrowed a Jang-gu drum for the children to explore during activity/project choice time.

The Jang-gu, a Korean Drum.

RA tries striking the Jang-gu.

During the music project, students did not attend a live performance by a full orchestra. In the classroom, the teacher introduced a video series called *Notes Alive.* The video series integrates music with a story and uses an orchestra to illustrate the book. The students viewed *My Many Colorful Days* and *On The Day You Were Born.* As the story progressed, the narrator talked about the sounds, movement and which orchestral piece was playing. Students observed and took detailed notes of each video.

Students made detailed sketches of the orchestra on the video.

The conductor shows students three different types of batons.

The Conductor

The students became very interested in conductors after watching the videos. They wanted to learn to conduct and ask a conductor some questions. The teacher invited her church choirmaster to demonstrate conducting for the class. He brought three batons for the students to try. He gave lessons on conducting music with three and four beats. His presentation included pictures of orchestra instruments and a video of him conducting a symphony, which illustrated his conducting technique. The students watched him in action. Then, he answered their questions

about the size of an orchestra, what "musician music papers" look like, and the name of the baton (whether it is called a stick, bow, wand or baton). Before his visit, students predicted how many people would be in an orchestra:

LB: 7 people
KM: 28 people
AW: 20 people
NW: 26 people
CB: 25 people

The conductor said that the number could vary depending on the music and what instruments were needed.

How are musical videos and songs produced?

The group of students who were interested in videos and cassette tapes toured a studio located in a private residence. The studio sound master and mixer talked to the group about creating a video. He guided the students through their own video production. He encouraged the group to explore his studio to find the right sound or action. The study group created sounds using items in the studio such as a door and various instruments. The sounds became a musical video showing each student performing some action. The studio sound master and mixer videotaped and edited the performance for the group. The students came back to school and explained the process to the large group. They watched their video and discussed in detail what they had created. The video was humorous and created lots of laughter and giggles. The students shared their musical video during the University Primary School Art Exhibition in April.

The videographer played examples of music to add to the students' video.

IL composed the music for the background of the student video.

What is the relationship between sound and music?

A small group of students researched sound and music thoroughly. They looked and listened intently in the classroom and out on the playground to find sound. A small group explored water levels in plastic cups. They made predictions about the highest pitch and lowest pitch. Half thought that the full cup would have the high pitch. The other half felt that the low level water in the cup would have the highest pitch. By tapping each cup and listening carefully, they found that cups filled with different levels of water had different pitches. Students also noticed that when the glass was tapped, rings formed on the water. The class discussed the similarity in the way sound travels to the waves in the rings in the water.

The next day the group experimented with water levels in glass cups. This experiment stayed on display for several weeks. For some this was a morning choice and they tried to create songs by tapping on the glasses.

EM taps the plastic water filled containers to find pitch.

The sound expert demonstrates that you can feel the vibration outside of a paper cup by talking into it.

Physicist Visit

A parent who teaches physics brought demonstrations to explore sound and vibration. First he asked the students to hold a paper cup up to their mouths and talk into it. The students could feel the vibration on the end of the cup. Next, he stretched a slinky across the room. The movement of a slinky demonstrated how sound travels. Students raced from one end of the slinky to the other as a student began a wave down the slinky. Everyone tried to beat the slinky wave. No one could do it. Students discovered how quickly sound travels.

Next, the physicist created a telephone with two paper cups and a piece of string. Students explored using yarn and straws in place of the string. Heavy cotton string worked the best in the classroom. The teachers made this activity available during project/activity choice time for the rest of the week.

To follow up on sound waves, the teacher set up an adult controlled experiment. She asked students if they could blow out a candle by tapping a box. The teacher fashioned an oatmeal box into a candlesnuffer. By cutting a hole the size of a dime in the lid, students could tap on the bottom of the box and send sound waves through the air to blow out the candle flame. Some pounded on the oatmeal box without much success. The students found that a small tap could put out the flame.

SW played a pan flute she created.

KM gently tapped the bottom of the box to produce sound waves that snuffed out the flame of the candle.

Piano and Organ

Students studying the relationship between sound and music were curious about a number of instruments and how they worked. They wanted to know, "How do pianos work?" and "Where do you find pipe organs?" Everyone enjoyed the field trip to the Piano People in Champaign. The piano expert explained how the keys worked on a piano. He told the students that the key strikes a hammer, which hits the wire. It vibrates and one hears sound. Steve pulled out a whole keyboard from a grand piano, which was made in Korea. There was a player piano at the store, too. It was computerized. The students sat on the keyboard design tiled floor and listened as it played.

The piano expert programs the electrical player piano.

Observational sketch of the player piano.

Elaborate tile on the floor of the Piano People.

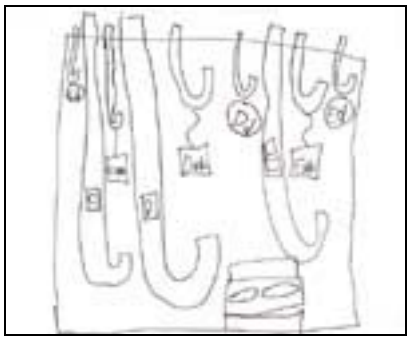
The piano expert demonstrates how the hammer hits the string inside the piano.

Students visited a church to find a pipe organ and to listen to a grand piano. The organist played the piano and pipe organ for them. By a stroke of luck, the pipe organ repairperson was there, too. He pulled a pipe out of the organ for them to observe. He blew in the different openings so that they could hear which would make the best sound. The pipes were connected to the organ by a series of tubes. Air is blown and stopped to create the sound.

The organ expert explains how an organ pipe makes sound.

The students created a pipe organ in the classroom using P.V.C. pipe, a box and a pair of thong sandals. The teacher cut the holes in the box ahead of time. She cut the pipe into varying lengths. The students added P.V.C. elbow connections and placed the pipes in the box. The pipes needed to be in size from smallest to longest. The students experimented and soon discovered that they did not have them in the right order. They took it apart and laid the pipes on the floor in the correct order first. Then they worked together to place them and join them together in the box. Students then numbered the pipes (1-6) from smallest to largest. Using the numbers on the box, DS, a student with advanced numeration and literacy skills, wrote a song to be played on the pipe organ and left it by the organ for other students to play. The pipe organ was an item on the choice board for several weeks for continued exploration.

Representation of the pipe organ.



Memory drawing of the pipe organ.

What is rhythm?

During Phase 2, a small group of students became involved in rhythm patterns. Individuals played a pattern and others in the group echoed it. The teachers introduced rhythm sticks to create patterns. Students progressed to using rhythm instruments and playing a pattern of rhythms. Drums, thumb guitars, pan flutes, maracas, cymbals, tambourines and shakers were a few of the instruments available for rhythm patterning. Playing these instruments was a favorite morning choice during project/activity time.

Over the course of several weeks, students began conducting small peer groups playing various instruments. The student conductors wrote their music by drawing pictures of instruments on sentence strips and putting them in order. The teachers introduced beat and rhythm by suggesting that students add numbers to represent the counts in a measure. Students interpreted this by writing the number of times they wanted specific instruments played. During project/activity time, students practiced conducting and then shared their performance at large group time.

KM points his baton to the music while conducting his orchestra.

Representations of Instruments

During their investigation of music, instruments, and rhythm, students created numerous representations out of boxes and junk of new and familiar instruments. Using boxes, egg cartons, paper cones and paper cups, they experimented with different fillers such as rice, beans and

metal bottle caps to create rhythm instruments. Plastic eggs became shakers covered in papier-mache. Students made wind chimes out of shells, sticks and string.

Some students chose plasticine and play dough to create instruments. Students drew outlines of instruments using paraffin wax bars. They applied a watercolor wash to the paper. The wax would not allow the paint to penetrate and created a lovely outline of the instrument. They also used tempera to outline and paint 2-dimensional representations of instruments.

Students also listened to music and finger-painted. They expressed their feelings through movement of the fingers in the paint. Finger paint was not popular earlier in the school year but when music was added it piqued their interest and kept them involved as they listened. Some stayed with one color. Others tried mixing various colors to capture the mood of the music.

EG finger-paints to the music using one hand.

MJ and SG experiment with several colors to capture their mood while listening to the orchestra.

In the weekly newsletter to the parents, the teacher invited families to attend a public concert entitled, “Journeys, a Concert for the Young and Young at Heart.” The teaching assistant in the K-1 Classroom, played the viola in the orchestra. Three families from the class attended and reported back to the class the following Monday. EG liked the harp. CG and WG enjoyed the flute that became the birds in the story. MF watched the pictures of Babar on the screen as the music played.

The teachers invited students to bring in CDs or tapes of music. They wanted to explore various types of music. EA brought an organ CD just before the class trip to hear a pipe organ. RA had a Jurassic Park musical CD. His group listened through headphones during choice time. He accompanied the music on a plastic tub, which he used as a drum.

NW shared a musical mat with the class. It was a keyboard that emits sounds when one walks over the keys. During a rainy morning, this provided stimulation for the group to explore music. They had fun by walking across the mat and making each note sound.

Students listen to Jurassic Park CD.

EM walks across the piano mat to create sounds.

When students brought instruments into the room, they first shared the instrument and entertained questions about their special instrument. WK shared his dad's guitar:

NW: When did your dad learn to play the guitar?
WK: When he found the pick
DS: How can you just tell about the neck of the guitar?
NW: It's the top.
DS: It connects the body with the tuning peg part. That's a long neck.
KM: Like a giraffe
LB: Did your dad take lessons?
WK: I don't know.
CB: Where did your dad get the guitar?
WK: Cincinnati.
SS: Where did you get the tuning pegs?
WG: It came with it
NW: They came on it.
WK: You can take a picture of me playing it.
ES: I already did. Could the guitar stay for two days?
WK: I might be sad if it did.

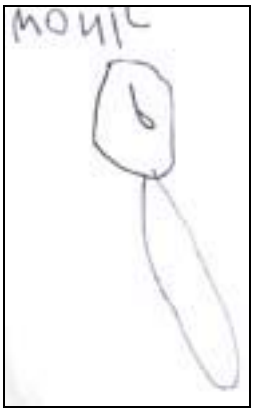
Several students liked to hide the instruments in bags or cases and have everyone make a guess as to what was hiding in the bag. This became so popular that the teachers began writing down all the answers documenting students' vocabulary. Everyone had a chance to give an answer. The person sharing called on people in the group. Some made logical guesses. Others became silly and just wanted to give an answer. After everyone had an opportunity to guess, the teacher posted the predictions with the correct answer on the chart paper. For the teachers, this game provided an opportunity for vocabulary to develop and for students to become more secure in taking risks and making predictions.

4/24/02

What's in Eric's Box? It was a clarinet!

CW: flute
CC: harmonica
RS: cymbals
EA: tiny guitar
CB: rock
DS: food
AW: flute
NW: candy

This was not a quiet project, nor was the classroom quiet during choice time. Every day there were new sounds from instruments that the students brought to class and shared during large group meetings. The teachers requested the instruments stay for a few days so that students had opportunities to do observational drawings or sketches. A few students created multiple drawings over time of the same instrument. To enhance their observation abilities, a teacher prompted the child to examine the instrument closer for details.



Time 1 drawing
MP draws the hand bell.

Time 2 drawing
MP shows more detail and labels the chime as a G note.

The head teacher brought hand bells into the classroom after spring break. Students played the brightly colored bells. They made observational drawings. The teachers placed blank paper and a cup of colored pencils that coordinated with the colored bells next to the display. Students began writing music that looked like colored blobs. Student composers read their own music and played the bells during large group meetings. The teacher purchased music staff paper and placed it next to the blank paper. Soon notation looked liked eighth and quarter notes, and not just whole notes.

CW plays the hand bells.

CG has composed a tune and is sharing it with the large group.

As the music project progressed, students' musical compositions increased in complexity. They expanded from using hand bells to incorporating drums, rhythm sticks or other child created instruments. The class explored many possibilities for sharing their knowledge with the parents. What did they want their parents to know about the music project? Students and teachers focused on answering this question during Phase 3.

Studying Music

Preschool Classroom

Phase 2 Photo Gallery

The assistant teacher played her flute for the class.

The violist plays for the class.

A sibling demonstrates the horsehair bow for his cello.

Korean drummers play with two hands on the wooden Jang-gu drums.

NW shared the guitar he made out of boxes and junk.

The assistant teacher demonstrates the pan flute.

NW's memory drawing of the string quartet's cellist.

Time 1 drawing of "French hose."

DS's drawing of the orchestra after watching the video.

The hand bell chime expert plays a tune for the class.

WK plays a drum brought from home.

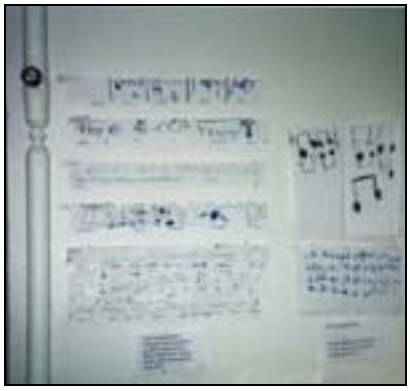
WK makes his own drum during project/activity choice time.

Studying Music

Preschool Classroom

Phase 3

DS and the head teacher practice the harmonica.



This is a display of orchestra music written by these 3/4 year old students.

Toward the end of the project, the students created a topic web about what they had learned (Student Music Topic Web 2). They wanted to share their new knowledge with their parents. Teachers guided them by providing the materials and supplies to make graphic representations of their experiences. Students prepared several different products to convey what they had learned about music. They created a mural, a ribbon dance, and several ensembles to perform music for their parents during an open house. They also shared their new musical experiences with others in the community.

Orchestral Mural

Throughout the project students drew many pictures to record their field experiences and the information gained by interviewing guest speakers. One small group of children decided to create a mural depicting the orchestra. They selected white butcher paper for the mural. Everyone started drawing on the huge piece of paper. Soon, someone mentioned that there was not enough room. Someone else wanted to draw a flute but there was one already on the paper. The students stopped and reorganized. The teacher gave students an individual sheet of white paper and a black marker. The teacher brainstormed with the students various instruments to place on the mural. To elicit responses, she gave clues of guest speakers or parts of an instrument. Each person chose an instrument to sketch. The teacher questioned, "How many people should be in our orchestra mural?" The students' answers were varied:

DS:	conductor	700 people
KE:	piano	150
GR:	Accordion	100

MJ:	violins	100
SW:	flute	80
LB:	ukulele	16
EA:	French horn	3

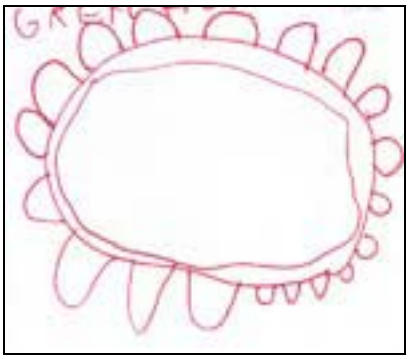
The teacher introduced a new medium, an acetate sheet for the background of the mural. To prepare for the large drawings, the teachers gave students white paper with black markers. When they were finished, students placed the pictures under the acetate and arranged them with the teacher's help so that they did not overlap. Students and teachers grouped similar instruments together when possible. Some children drew huge instruments and others drew smaller ones. After agreeing on the placement, students traced their picture with a permanent marker.

Students create a rough draft of the orchestra mural.

Students paint their orchestra mural on acetate.

The group discussed how to get color onto the mural. Students voted to use tempera paint. At the next project group time, the students painted and painted. Some covered their outlines so thoroughly that you could not see the instrument. They found that when it was flipped over they could see an instrument and the tracing marks but the labels were backwards. The students decided not to change it and they displayed it on the window. After the weekend, they came back to find that the tempera paint had chipped off the acetate. The teacher took the opportunity to teach problem solving explicitly and told the children it was time to go "Back to the drawing board!"

GR drew two instruments for the mural.



GR decided upon the tambourine for the mural.

GR suggested that they use watercolor paint this time. The teacher returned their first sketches to the students and provided a new piece of acetate. The children traced their pictures again. LB made a mistake with the permanent marker. She was upset about her drawing and cried. The teacher provided rubbing alcohol to remove the permanent marker. It worked and brought a quick smile to LB's face. She happily traced her instrument again. The watercolor paint created a soothing effect. The murals hung side by side in the windows. The display of the first and second attempt to complete the final product demonstrated the problem solving that took place in the process of designing and painting the mural.

The Ribbon Dance

Throughout the project, the students who studied movement introduced their work at group meetings and invited others to participate. The assistant teacher initiated the ribbon dance to provide a medium for students to experiment with the relationship between emotions, movements, and music. Students enjoyed creating their own ribbons and practicing during project/activity time. They used different colored ribbons to portray different feelings when they danced. They practiced the ribbon dance indoors in case it rained on the day of the open house. The teacher used a CD of different orchestral selections. As the teacher called out a particular ribbon color, those students having that color came into the circle to dance. The teacher encouraged students to vary their body movements and waves of the ribbon for the different musical pieces. During the open house, all of the students joined in the dance and waved their ribbons to the music. The expressions on their faces during their performance "said it all" to the parents and teachers.

The ribbon dancers display differences in feelings evoked by the music.

DS conducted his orchestra during the parent open house.

Student Ensembles

Student conductors created ensembles with their peers. Each group had a different conductor who used movements that the expert conductor taught them when he came to visit the classroom. When the students wanted the music to end, they opened their arms wide to signal. Most

members of the student ensembles paid close attention and quit on cue. The ensembles played several selections that the student conductors had previously composed. The conductor followed the music symbols written on sentence strips.

Sharing in the Community

During large group meetings, the teachers taught students many new songs. The teacher assistant led the group in *I am So Happy* in five different languages. The head teacher introduced students to "echo songs." They learned the echo song called *Rain, Rain* by Miss Jackie. When the Care Center of Champaign invited the preschool students to celebrate "Hat Day" with them, the preschoolers were eager to give the residents a performance of their repertoire. The students designed and made their own hats before they went. They had a parade and sang their songs including a number song that they created.

Colorful hats adorn the singers as they ring out the song, *Rain Rain.*

Vocabulary

Throughout the room, teachers displayed pictures of students' drawings and work related to the music project. The displays featured new vocabulary introduced to the students. The teachers also kept a list of words on the "word wall." The vocabulary students acquired included:

beat
blow
bow
chime
cello
conductor
drumstick
echo
eighth note
flugelhorn
glockenspiel
grand piano
half note
harmonium
instrument
keyboard
music stand
neck
orchestra
organ
peg
play
player piano
pick
pipe organ
quarter note
rhythm
rock stop
shake
songs
string
strum
tabla
tambourine
valve
vibrate
vibration
whole note

Open House

To culminate the music project, teachers and students invited families to attend an open house that featured various performances, displays, and snacks. The displays highlighted the process of answering the students' questions about music. Exhibits included charts with questions, predictions, and answers given by the visiting experts. Parents saw the three-dimensional models of instruments including the pipe organ. The process of students learning to write and conduct their own music was also displayed. The program brochure invited parents to look around the room and find evidence of the following:

Korean drummers
Visit to the Piano People
Writing our own music
Representations of musical instruments using play dough and plasticine
Word wall and vocabulary of instruments
Make low and high sounds with the pipe organ
Tap the water glasses to make a song.

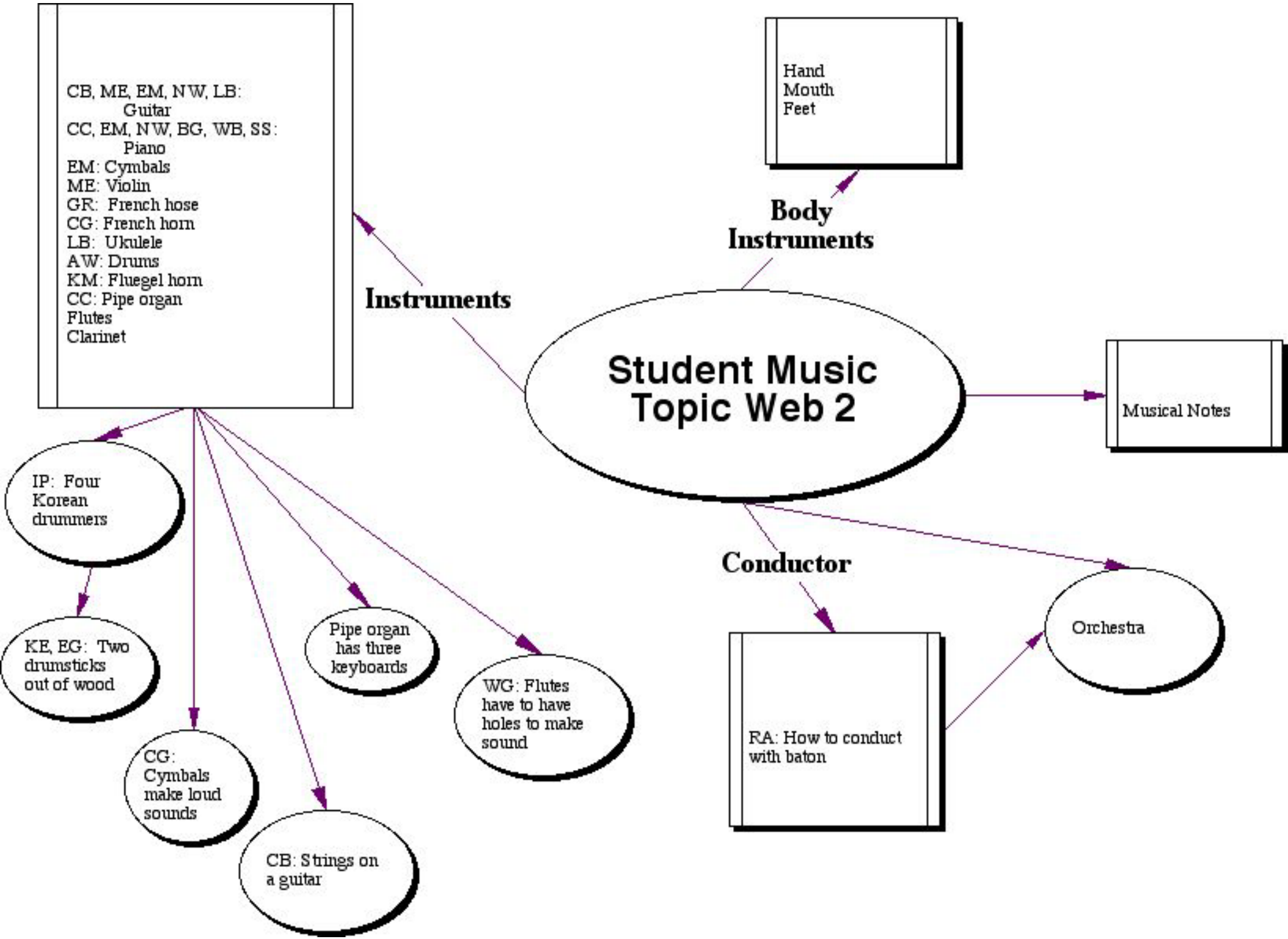
The program included students singing echo songs, doing the ribbon dance, and students conducting ensembles. After the students performed, parents walked around the room with their children and explored the displays.

Parents read the wall display after the student performance.

New or Deeper Understandings

Studying Music gave students a richer understanding of the music found all around them. In particular, students gained specific knowledge about instruments that originated in different cultures and are part of the family traditions of their peers. At a very basic level, students gained some knowledge about the relationship between sound and vibration. Students learned that you could stop the vibration of a chime by placing it against your body or on a clothed surface. They now know that sound travels in sound waves. Physically running and trying to beat the sound wave (slinky) helped them understand how fast sound travels. The students generalized that different sounds come from different objects and they can manipulate and create new sounds by placing various objects inside shakers.

Students learned how to cooperate and make music together. They recognized the importance of having written music compositions and of following a conductor. They learned that music could be written down with specific symbols representing notes and rhythm. Most of all, students enjoyed the music project and became fully engaged in creating, listening, and moving to music. In the next section (Evaluation), the teachers share their reflections about the project and evaluate it by examining the documentation for growth of the group as a whole and for specific students (student portfolios).


CB, ME, EM, NW, LB:
Guitar
CC, EM, NW, BG, WB, SS:
Piano
EM: Cymbals
ME: Violin
GR: French hose
CG: French horn
LB: Ukulele
AW: Drums
KM: Fluegel horn
CC: Pipe organ
Flutes
Clarinet
Hand
Mouth
Feet
Body
Instruments
Instruments
Student Music
Topic Web 2
Musical Notes
IP: Four
Korean
drummers
KE, EG: Two
drumsticks
out of wood
CG:
Cymbals
make loud
sounds
CB: Strings on
a guitar
Pipe organ
has three
keyboards
WG: Flutes
have to have
holes to make
sound
Conductor
RA: How to conduct
with baton
Orchestra

Studying Music

Preschool Classroom

Phase 3 Photo Gallery

DS draws the conductor for the mural.

IL listens to the shakers to compare the sounds.

EG shares a rain stick with the class.

Percussion ensemble plays a rhythm for the class.

Making observational drawings of a drum from Africa.

IP's story about an orchestra.


Everyone moves to the beat.


Head teacher leads the group in song during the open house.


Ribbon dancers feel the music and express themselves through dance.


A father videotapes the information on the wall.

Studying Music

Preschool Classroom

Music Project Video Gallery

The parent demonstrates that the tablas consist of a large and a small drum and are played together. He points out that they are played with the fingertips and hands. This is different than playing the bongos.

Students listen to the classical pianist when they visited the church.

Students learn the Macarena during project/activity time. Some students accompanied the dancers on the drums.

Students are exposed to organ music during their visit to the church.

The visiting percussion ensemble played musical pieces using ordinary household items. The preschool students enjoyed hearing the spoons and pots and pans.

The chime expert played a scale for the students.

The pipe organ expert explained how he moved the pipes to make them longer or shorter to tune the organ.

The assistant teacher from the K/1 classroom plays on his viola a variation of a familiar tune for the preschool students.

Studying Music

Preschool Classroom

Evaluation, Reflection, and Assessment

The criteria for developing high quality project investigations include making sure that the topic is worthy of study and meaningful to the students. Not only was this topic worthy of study because music is so prevalent in students' lives, but music is deeply rooted in family and cultural traditions. Students had opportunities to share music that was familiar and personally meaningful to them, and they were exposed to music that expanded their horizons.

In the fall, a few parents shared their musical talents with the class. Students heard a flugelhorn, accordion and a guitar. Students brought instruments from home including a ukulele, zither, guitar and flute. The daily morning schedule included singing and movement in large group meetings. Some parents commented that their children would like to do a project to study more about music. To the teachers, the music topic seemed liked the right choice for the spring semester.

Teacher Reflections

The teachers enjoyed having students share instruments from home. With their instruments, students created rhythm or sound patterns to dismiss each child from the large group meeting. For example, a student might tap the drum twice for a two-syllable name or shake a maraca three times to dismiss a child with a three-syllable name. The students truly enjoyed creating a variety of shakers, drums, guitars, autoharps and flutes from the boxes and junk materials. They shared their handmade instruments at large group. The class, being culturally and linguistically diverse, was fortunate to have families and staff share instruments from India and Korea. This expanded the knowledge base for the children.

Students knew that instruments made sound. However, they were very curious to learn how sound was made. Thus, the music project included abstract principles of physics. Students explored these concepts with first-hand inquiry and a "hands-on" approach. The physicist gave students experiences so they could feel vibrations and demonstrated sound waves with a slinky. Students raced the slinky as it illustrated how sound travels. This sparked creative experimentation and strengthened the students' dispositions to inquire as they designed new experiments with straws, yarn, string, paper cups and plastic cups. They manipulated variables to produce sound waves.

The music project provided opportunities for many people to get involved, including parents with musical talents, staff members with connections to musical groups, local professional music ensembles, and the students themselves who were eager to share their instruments from home. Each guest expert shared their knowledge and answered the students' questions. Most of the musicians let the students touch or play their instrument. One speaker left his French horn in the

room for several days so that students could create observational drawings. The musicians played familiar and not so familiar tunes. This exposed the students to more genres and styles of music.

The teachers prepared the music experts for coming to the class by informing them about the age of the students and what they were studying. In some cases, the teachers helped the guests transform difficult concepts to ones that could be understood by a three or four year old by choosing familiar music, interpreting students' questions for them, and providing materials when necessary. The teachers also asked students to brainstorm their questions ahead of time and to make predictions about how the speaker would respond to their questions. Not only did this encourage critical thinking on the part of the students, but it also gave the teacher some questions to give the guests ahead of time.

The field experiences were particularly rich with new information for the students. The teachers were pleasantly surprised to find the pipe organ repairperson on the visit to the church to see the pipe organ. He shared detailed information about how an organ pipe works. Field trips also introduced students to how pianos made sound, how recording artists made CD's and videos and how choreographers created dances.

Vocabulary greatly expanded during the project. The students first referred to "sticks" used for violins and cellos. By the end of the project they were calling them bows. "Conductor" was a new word for some. The "word wall" in the classroom grew as new vocabulary became apparent to the group. Some of the literature that the teachers read during group times inspired not only musical nomenclature but also rhyming nomenclature. The preschoolers loved coming up with rhyming words.

The Teachers Balance Between Leading and Facilitating

During initial planning, the teachers thought one idea for the culminating event of the music project would be the creation of a musical. The students enjoyed writing plays in the fall and the teachers thought that the music project provided an avenue to extend play writing by adding music and lyrics. However, the students did not seem to want to pursue that path. At one point they made a disco ball and turned their dramatic play room into a party room. The teachers thought that the disco party room would remain open for the final open house. However, after two weeks of playing in the party room during project/activity time, students lost their initial enthusiasm. Instead, students became enamored with their creation of instruments and turned the dramatic playroom into an instrument museum. (The culminating activity for the fall project on "Balls" was a "Ball Museum"). The model of the pipe organ and rhythm instruments were housed in the instrument museum.

The idea of an orchestra expanded and grew as the project progressed. It started with videos that linked a story to a selection of music. The students were particularly intrigued with the role of the conductor. The teacher, taking the students' interests seriously, invited a conductor to come and talk to them. Conducting became an opportunity for leadership. Student conductors wanted to write music for other students to play. The students formed small rhythm groups during

project/activity time. The teacher facilitated their growth in writing music by suggesting students add counts to their music and notate how long specific instruments should be played. It was interesting that students interpreted the length of playing by writing instead how many times an ensemble member should strike a specific instrument. For example, the sentence strips had icons of instruments and numbers next to the icons standing for the number of times the conductor wanted the person to play the instrument. Led by a student conductor, ensembles rehearsed during project/activity time for weeks. Three of the ensembles performed during the culminating open house.

Authentic Literacy

Writing music became the rage for some students. It was very interesting to watch the growth from colored scribbles to actual musical notes on staff paper. One student used a computer program to make staff paper and added notes to the creation. Student composers had an authentic need to write down their music because they wanted the members of the ensemble to understand when to play their instruments. Each time the student composers played their music at a large group meeting, they were reading the music from left to right, even though the teachers did not explicitly teach left to right progression.

Growth in Knowledge About Instruments

Evidence in students' growth of knowledge about instruments was present in the comparison of the beginning and ending student topic webs and in the numerous detailed drawings and three-dimensional representations of instruments. The students focused more on particular instruments when they brainstormed what they had learned about music (Student Music Topic Web 2). Six students mentioned the guitar. In the first web (Student Music Topic Web 1), only two people mentioned the guitar. RA mentioned that the conductor uses a baton to lead the orchestra. The words, "conductor" and "baton" were not on the first web. WG noted that flutes have to have holes to make sound.

Students also revealed new understandings about instruments through conversations, predictions, and discussions after field experiences. Before the trip to the piano store, the teacher asked pupils as they were greeted in the morning "How many legs does a grand piano have?" Most answered that a grand piano had four legs. Students observed at the piano store that the grand piano only had three legs. Before the trip, one student remarked that a bicycle could carry a piano. He changed his opinion after he saw the large size of the piano at the piano store.

If not for the fact that school was ending for the year, the teachers and students could have engaged even longer in the study of music. The students' interest remained at a high level throughout the course of four months. This was an excellent project for participation. Everyone created instruments to share at large group meetings and take home. Some expressed their creative thinking by composing and writing music. All enjoyed performing in the ribbon dance and using their imaginations to move to the music.

This study made the students aware of music and instruments from around the world. Students had an in-depth look at several unique instruments such as the pipe organ, Jang-gu drum and hand bells. Students experimented vigorously with different patterns of rhythm. They enjoyed creating patterns using their bodies as well as the rhythm sticks. They came to a deeper understanding and a greater appreciation of the role that music plays in their daily lives.

Student Reflections

On the very last day of school, May 31, 2002, the teacher asked the students in the final group meeting what they liked about their music project. She passed a tape recorder and a microphone around the circle to elicit responses from the students. Their responses indicated that they enjoyed many different aspects of the project, and particularly the different instruments.

WG: I like trumpets.
CB: My dad brought a trumpet.
WG: There are two kinds of trumpets - a flugelhorn and a trumpet.
BL: I like trumpets. He makes a sound.
MP: I like flute. It plays music. I have a flute. I have a flute made of wood. My daddy plays the flute and my daddy doesn't play a flugelhorn.
AW: I like trumpets. I like how it makes sound.
LB: Different instruments make different sounds. A flute makes a high sound. A drum makes a low sound.
CB: I like a trombone. Because they make music. With the ear. No I mean the air. It comes out of your mouth.
KM: I like autoharps. You just get a pick and start playing. You don't have to carry it. You just start playing it.
DS: I want to talk about vibration. All the instruments vibrate. Like when you hit a drum it vibrates. When you pluck a guitar string, you can see the string vibrates. When you strum the string and press the button, the string vibrates. Music comes from everywhere. You can play music with everything. Everything can turn into an instrument, bottles, cans, everything! Your shoelace, everything. Even that clock ticks and that's how it makes music.
CW: I know about French horns. They vibrate. Jim played a hose, a French horn the pretend one.
RS: I like trumpets.
EG: I like drums because they are so, so noisy.
WK: I like instruments.
IP: I like a trombone and everything.
EM: I like everything in the whole wide world and cellos.
NW: I like everything in the whole world. Uh cellos.
MJ: I like piano because I like the sound how they play it. My sister plays the piano.

Parent Reflections

During the open house, teachers placed a parent questionnaire on the table and asked parents to please complete the questionnaire before they left. Only a few parents returned it. In retrospect, they were probably too busy during the open house to complete it. The following responses although not representative of the whole group, provided valuable feedback to the teachers:

1. What evidence have you noticed at home to show that your child is studying music at school?

    - WK recognizes instruments, enjoys music and movement now.
    - MJ talks about notes, sheet music, different instruments, and sings songs.
    - He has been dancing more and singing new songs. He shows increased interest in music where he is already very tuned in.
    - She is more interested in music and can identify different sounds of instruments.
    - Playing of ukuleles, accordions, etc. singing and asking for piano lessons.
    - He plays a small drum at home.

2. What new language or vocabulary has your child used during our music project?

    - Some with parts of different instruments from field trips and visitors.
    - Wide range of types.
    - Lots of new words. Heard him singing while playing.
    - Saxophone is certainly a new and often used term.
    - None noticed
    - Pitch, mode, keys.
    - To be honest, not too much.

3. What new information has your child gained through the project?

    - He pays more attention to music.
    - Learned names of instruments and can draw their pictures.
    - I think that she finds it interesting that the notes can be read to make music. She is also enjoying Lawrence Welk on PBB more than usual.
    - I think he's gained a greater appreciation for music in all its forms, including singing songs he's learned for all of us.
    - Loads. MJ had limited exposure to music and instruments so he learned a lot.
    - Range of types of music he hadn't listened to before. Saw so many instruments and experienced such variety. Learned how to do the orchestra group thing.

Student Portfolio – DS

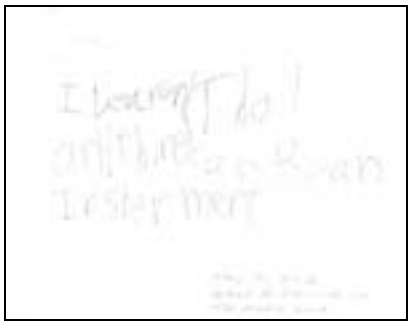
DS is a highly verbal child who turned five early in the fall and was reading at the fourth grade level in January. This was his second year in the preschool classroom and he was well beyond

most of his classmates academically. His father was the visiting expert on sound and throughout the project DS had an intense interest in the physics of sound. His mother was one of the parents who suggested that the class pursue a project on music.

The teachers felt that DS knew a great deal about music before they started the project. In the beginning topic web he mentioned the words duet, trio, quartet, and quintet. He also was familiar with making rhythms with his bodies and mentioned the flute and the paper drum. However, the teachers continually presented new information and challenged him throughout the study of music.

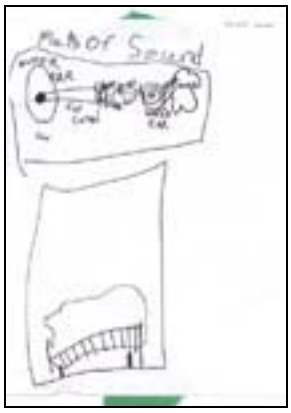
During the presentation on tablas, DS verbalized that he did not think the voice was an instrument. At the end of the project, an adult volunteer questioned the students about what they had learned. DS responded, "I learned that anything can be an instrument."

Is the voice an instrument?



DS writes a response to the question, "What have you learned during the music project?"

DS also had an interest in mapmaking. In the previous project on vehicles, he created all kinds of maps of how to get to his house, maps of his vacation routes, treasure maps and even a map of the systems of the human body. During the music project, DS illustrated for the other students how the ear works by drawing a map of sound.



DS labels parts of the ear and how sound travels.

DS grew significantly in his ability to collaborate and socialize with his peers. The music project gave all students new experiences and new vocabulary to share. With the introduction of instruments from different countries, students had common ground to explore and extend their knowledge base. DS performed in and conducted ensembles, giving him authentic opportunities to engage in camaraderie with his peers. At parent conference time, his parents were pleased and noted an increased engagement with other students in the classroom.

Student Portfolio – RS

RS was three years old when he entered University Primary School in the fall. Like most three year olds entering the program, it takes some time getting used to signing up for choices for project/activity time and becoming engaged in project activities. Although he participated in teacher-guided groups during the fall project investigation about "Balls," he became totally engaged and initiated activities that related to the music project.

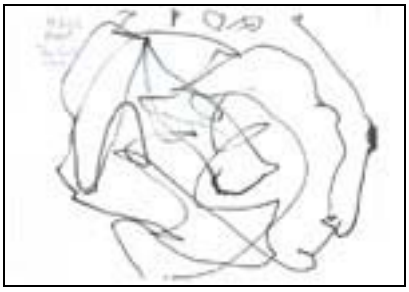
Even at three years old, it was obvious that he had numerous previous musical experiences and that he had a real interest in the topic. He mentioned that he had taken movement classes at the Ballet Academy and at Kindermusic. He answered in the music survey that the students developed that he had a guitar, drum, piano, bells, sticks, recorder, dulcimer and glockenspiel at home. He shared many of his own instruments at group time. During the semester long project RS also became intrigued about instruments from other countries.

When the group sent home a survey about musical instruments, RS helped tally and create a number graph to show the data collected. The group found out that the most common instruments found in their homes were a guitar and drum.

RS works on the survey about instruments found at home during project/activity time.

Simple to Complex

RS demonstrated his increased attention to detail in his observational drawings of the French horn. Notice in the second drawing that RS dictated labels for the teacher to place by his instrument and he added more details. His growth in literacy is evident. He began to add his name in late April.



4/3/02 – Time 1 Drawing
RS draws lines to represent the French horn.

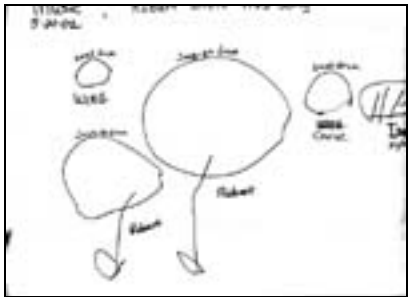
4/23/02 – Time 2 Drawing
RS draws more details and dictates labels to parts of his French horn drawing.

RS drew a memory drawing after going to the Ballet Academy for a movement experience. RS stated, " I used to take classes there," when talking about the Ballet Academy. His favorite part of the trip was the batons "because they are shiny."

RS remembers moving like a snake at the Champaign-Urbana Ballet Academy.

Few Facets to Multifacets

RS designed ways to write his own music so that he could be a conductor and have a group of students play his song. The preparation to be a conductor included many tasks. First he had to decide what instruments he wanted to include in his music. His music included drums and cymbals. Then he had to design a way to notate his intentions. Notice the small and large pictures representing the instruments. Then, with a teacher's guidance, he assembled the group for rehearsals and finally, conducted his ensemble for the class during large group meetings.



RS composed music that he conducted at a large group meeting.

Smaller Leap to Greater Leap

RS participated in the music project from day one. During the fall project, RS was not as motivated. In this project, he progressed from sharing instruments he brought from home to writing music that he conducted during the culminating activity. When he brought an instrument, RS liked to be the one to dismiss group by beating out a rhythm or blowing the child's name into the instrument.

RS shares an instrument with the large group.

RS demonstrates the different sounds coming from the different size drums.

Disposition to Inquire

The music project provided opportunities for very young children like RS to develop questions to ask experts. Initially, RS asked general questions such as "Where were you born?" When an older elementary aged sibling brought a cello and played it for the class. RS asked him, "How do you play cello?" He wanted to know specific answers to questions about instruments.

RS creates an observational sketch of MJ's violin.

Student Portfolio - SS

SS entered the preschool program at four years old and turned 5 in the early fall. For most of the four year olds it is their second year at University Primary School because they continue after their first year. However, being new to the program, project investigations were still relatively new to SS.

Extending the Comfort Zone

SS went beyond her comfort zone by playing an instrument that was familiar to her to exploring the new instruments in the classroom. Initially, SS brought her mother's viola to share with the class. She sat for several days and played it by herself at project/activity time. She progressed to

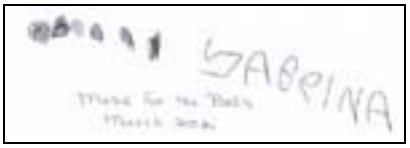
trying other instruments. The hand bells are an excellent example. When the bells were placed as a choice for project/activity time, she tried them out. Soon she chose the hand bells daily. She also participated in the group activities such as making sound waves with water and plastic cups, and creating artwork that detailed the instruments shared in the classroom.

SS plays her mother's viola during project/activity time.

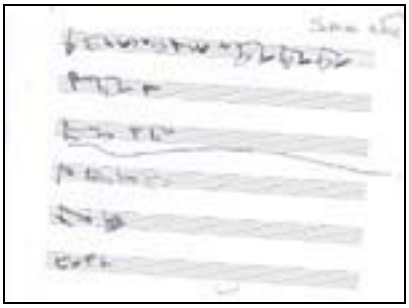
SS plays one of her compositions on the bells.

Simple to Complex

SS enjoyed playing and composing different pieces on the hand bells. She wanted to write down her music and was one of the first to do so in the classroom. Her first music contained notes that were colored pencil dots that matched the colors of the hand bells. She played her song for the others during the large group meeting. She wrote several more songs. Each one became more detailed. She wrote her final composition on musical staff paper. It contained eighth notes, quarter notes and whole notes.



SS attempts to write music for the bells.

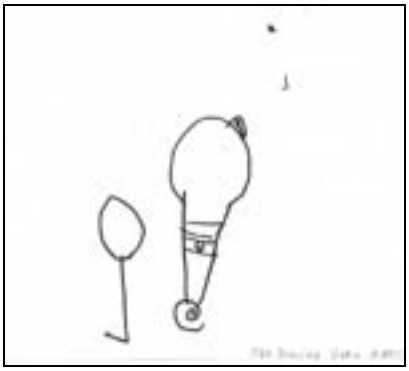


SS adds more details to the written music. Notice the eighth notes!

Few Facets to Multifacets

SS knew about violins and pianos. She commented before going to the Piano People store, "Pianos are bigger than violins." Her sketches of instruments became much more detailed. The February picture of a violin shows the bow and the violin. The memory drawing of instruments shows that she had knowledge of a few. The painting of the violin demonstrates a growth in

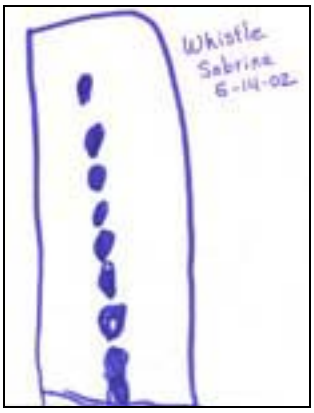
understanding about the shape and form of the instrument. Notice the greater detail of the strings and the bow at its side.



2/28/02
SS sketched a violin.

4/30/02
SS painted a violin with strings.

SS created an observational drawing of a train whistle. Notice the sharp corners and finger holes.



SS creates an observational drawing of a train whistle.

Smaller Leap to Greater Leap

SS typically gave comments about her own experiences in group discussions. In the music project, she began paying closer attention to what other students were sharing and began asking questions that had depth and some detailed knowledge of instruments studied. Here are some samples of comments and questions:

> "I am so good, such a good job at my piano toy. My mom is going to give me Piano lessons. The next day and tomorrow. After tomorrow, I'm going to Kindergarten."

SS asked the conductor, "What instruments do you play?"

SS asked the French horn expert, "Can you make a bad sound?"

SS wanted to know from a sibling, "Where did you get your music book?" After he played for us, she asked, "Why do you have color tape on your cello?"

SS asked the guitar player, "Where did you guys get the tuning pegs?"

She surprised the teachers and the French horn expert when she asked if he could make a bad sound with his instrument. She realized that instruments make sounds that listeners think are "good" and "bad."

Growth in Initiative and Leadership

SS explored music and rhythm on her own, and then used her rhythm skills and knowledge to create her own music group during project/activity time. She gathered two friends for a percussion ensemble. One played various drums and the other the keyboard. SS grew in her confidence and ability to lead a group of children in an activity. Her disposition to socialize and make music with her peers also strengthened. She grew emotionally as well. In the beginning, she wanted to share every piece of music she wrote with the large group. Toward the end of the project, she gained self-satisfaction knowing that she had created her own music. She often just wanted to write it down for herself and take it home. SS certainly increased her interest in music. By the end of project, she wanted her mother to enroll her in piano lessons!

SS plays with a spontaneous percussion ensemble during project/activity time.

Studying Music

Preschool Classroom

Music Calendar

Step-by-Step Lessons

Phase 1

1 Opening Event Teacher shares a story about going to the ballet and listening to music while the dancers performed.	**2 Brainstorm Ideas** Children brainstormed ideas about music.	**3 Categorize Ideas** Teachers placed ideas into categories directly on the chart paper.	**4 Label Categories** Students add to their ideas about music on the Student Music Topic Web 1.	**5 Share Personal Stories** Students share stories and memories about music at large group meetings. Teacher typed dictated stories on the computer.
6 Illustrate Stories Students used a variety of media to illustrate the memory stories. Students used plasticine and play dough to represent instruments from their memories. They also chose to paint their experiences.	**7 Share Stories** Students shared stories and pictures at large group meetings. Teachers then displayed the stories and pictures on the wall.	**8 Collect Data** One group decided to find out which instruments were found in most homes. They prepared a survey for parents to complete at home.	**9 Represent Findings** During project/activity time, teachers facilitated analyzing data and helped students create a bar graph to display their findings.	**10 Articulate Questions** Teachers and students wondered about music. Students dictated a list of questions that they had about music and instruments.

Phase 2

11 Group Planning Teachers articulated researchable questions from students' list of questions. Students began exploring music in small groups according to their interests.	**12 Make Predictions** Before each site visit or guest speaker, students brainstormed questions for the experts, and predicted their responses.	**13 Engage in Field Work*** Students began collecting data to answer their music questions. Teachers planned field trips to a piano store, church, recording studio and a ballet academy. Students made observational drawings of many instruments. They explored expressing their feelings through music and movement.	**14 Debrief** Small groups shared their findings at large group meetings. Recording studio group brought back a video that they created. The class watched it several times.	**15 Create Representations** Teachers placed clay, play dough, boxes and junk and paint in the art area for students to represent instruments.
16 Share Each group shared at large group the progress they were making or new findings that they discovered.	**17 Plans for a Visiting Expert** Students formed ideas and opinions about sound and vibration before the sound expert came.	**18 Expert Visitors** The physicist shared new knowledge about sound and how it travels. Children participated in feeling sound waves and chasing them. Other visitors included a violist, a hand chime expert, parents who shared their instruments, and music ensembles.	**19 Debrief** Students share what they've learned from the physicist. They share ways that they explored sound using other materials such as straws, yarn and paper cups.	**20 Continue Investigation** Students create sound experiments and share their findings. They make shakers with various items such as beans and rice. Students compare sounds between plastic and glass cups. They observe ripples that are created when they tap cups with a stick. Students composed songs by tapping the cups.

Phase 3

21 Representations Students made many 3-dimensional representations of instruments, including a pipe organ from PVC pipe and a cardboard box.	**22 Articulate What Students Have Learned** Large group discussion centers on what students learned about music.	**23 Brainstorm Second Topic Web** Students brainstorm ideas for the Student Topic Web 2, what they now know about instruments and music.	**24 Label and Categorize Ideas** With the teachers, students categorize ideas and complete the second topic web.	**25 Plan For Sharing** Students brainstorm ideas for the culminating activity. They decide to share the ensembles, ribbon dancing and echo songs. They plan to create a mural of instruments in an orchestra.
26 Project Highlights Students practice with specific music for ribbon dance. Students choose songs that they want to share. Student conductors form ensembles to perform for parents.	**27 Imaginative Activities** Students turn their dramatic playroom into an Instrument Museum. There they display their representations of their own instruments.	**28 Display** Teachers and students complete items for the class displays and hang the murals on the window. (Approximately 1 week of preparation).	**29 Culmination** Parents gather in the classroom to hear the songs, see the ensembles perform as a student conductor leads them, and watch the ribbon dance. They tour the displays with their children.	**30 Evaluation** Students record what they liked about music on a tape recorder. Parents respond to a survey about what they think their children have learned. Teachers evaluate students' progress by examining documentation in student portfolios.

*This phase of the project takes several weeks.

Studying Music

Preschool Classroom

Music Resources

Primary Resources

Experts and Musicians

- Cellist
- Champaign-Urbana Percussion Ensemble
- Champaign-Urbana String Quartet
- Conductor
- Drum Group (Korean)
- Flutist
- French horn player
- Guitarist
- Hand Chime Expert
- Harmonium and Tablas musicians
- Keyboard player
- Physicist on sound
- Pianist
- Pipe organ repairperson
- Violist

Hands on Materials

- Beans
- Boxes and junk
- Candle
- Cardboard
- Colored Wire
- Computers Instruments (variety)
- Oatmeal Box
- Paint
- Paper (all types and sizes)
- Paper cups
- Papier-mache
- Paraffin Wax
- Plastic Eggs
- Plasticine
- Play dough

- Rice
- Slinky
- Tape Recorders
- Video Camera
- Watercolors

Field Site Visits

- C-U Ballet Academy (movement)
- Jesse Brown's home studio (create video)
- Piano People (piano store)
- University Place Christian Church (pipe organ and piano)

Software

- Inspiration
- KidPix
- Kid Phonics2

Secondary Resources

Books

Lithgow, J. (2000). *The remarkable Farkle McBride.* New York: Simon and Schuster.

Martin, B. (1994). *The maestro plays.* New York. Henry Holt & Company

Mattox, C, W, (Ed.) (1991). *Shake it to the one that you love the best: Play songs and lullabies from black musical traditions.* Nashville, TN: JTG of Nashville.

Nelson, E. (1982). *Singing and dancing games for the very young.* New York: Sterling Publishing.

Sabbeth, A. (1997). *Rubber-band banjoes and a java jive bass.* Indianapolis, IN: John Wiley Inc.

Weissman, J. M. (1987). *Sniggles, squirrels, and chicken pox.* Beltsville, MD: Gryphon House.

Wood, A. (1986). *Moonflute.* Chicago: Harcourt.

Wood, A. (1989). *Three sisters.* New York: Penguin Putnam.

Books and Tapes From Listening Center

Arnosky, J. (2000). *Rattlesnake dance.* New York: Putnam.

Moss, L. (1995). *Zin zin zin, it's a violin.* New York: Simon and Schuster.

Seeger, P. (1994). *Abiyoyo.* Aladdin Paperbacks.

Tabak, S. (1997). *There was an old lady who swallowed a fly.* New York: Viking Children's Books

Trapani, I. (1998). *Twinkle twinkle little star.* Watertown, MA: Charlesbridge Publishing.

Trapani, I. (1998). *The itsy bitsy spider.* Watertown, MA: Charlesbridge Publishing.

Trapani I. (2002). *Row, row, row your boat.* New York: Whispering Coyote Paperback.

Witt, D. *The wheels on the bus and other transportation songs.*

Music CD:

Disney, W. (2001). *Mary Poppins sound track*. Burbank, CA: Disney.

Saint-Saens, C. (recorded 1988). Carnival of the animals. In *The best of Saint-Saens.* London: Emd/Emi Classics

Video

Heitzeg,, S. (1997). *On the day you were born.* Minneapolis, MN: Minnesota Orchestra.

Seuss, D. (1999). *My many colorful days.* Minneapolis, MN: Minnesota Orchestra.

Studying Music

Preschool Classroom

Music Learning Activities Across the Curriculum
Relationship to NAEYC Accreditation Criteria

Arts and Aesthetics (B-4, B-7, B-7e, B-7g,B-8)

*constructing (B-5d, B-7g)
- construction of 3-dimensional pipe organ
- construction of instruments with wire or plasticine

*creative dance and movement (B-7g)
- add to rhythm by using body parts
- dance with ribbons moving to the music
- dance to Flaminco music, Macarena
- listen to music and move as an animal in *Carnival of the Animals*
- move to the feel of the music

*dramatizing (B-7g)
- dramatize *Peter Pan* play using only music
- use creative dramatics to explore music

*memory drawing (B-7a)
- draw memory experiences about music
- draw instruments that we see on field site visits
- draw instruments that were brought to the classroom

*observational drawing (B-7g)
- draw instruments were brought to the classroom (Time 1 and Time 2)
- revisit Time 2 drawings and add detail to drawing

*painting (B-7g)
- paint musical instruments
- paint watercolor wash over outlines of wax instruments
- paint mural for culminating display

*relating art to literature (B-7d)
- draw pictures to respond to *My Many Colorful Days* by Suess.

*representations (B-7g)
- create music staff on computer using Kid-Pix

- create musical instrument mural on acetate
- draw pictures of instruments
- make three dimensional instruments from plasticine, wire and play-dough

*responding to music (B-7g)

- create rhythm patterns using rhythm sticks
- listen for high/low sounds
- listen to music and finger paint to the mood evoked by the music
- listen to music and draw a picture using crayons
- listen for rhythm patterns
- listen to various music forms and instruments

*Singing (B-7e, B-7g)

- practice and sing echo songs for culminating activity *Rain, Rain*
- sing *I Am So Happy* in five different languages
- sing songs from *Sniggles, Squirrels and Chicken Pox* by Miss Jackie W.

Language and Literacy

*analyzing (B-6a, B-7c, B-7d)

- analyze information gathered from field studies (videotapes, expert interviews, photographs, instrument analysis)

*classifying

- classify pictures of instruments
- classify questions that students asked to pursue in study groups
- sort and classify student topic webs one and two

*comparing (B-7c, B-7d)

- compare different types of instruments
- compare the sounds of instruments
- compare sounds in cups of water

*critical thinking (B-7c)

- decide on presentation material for culminating event
- predict, hypothesize or theorize the answers to questions
- decide how to proceed on mural after first attempt

*developing oral language (B-7d, B-7g)

- brainstorm music concepts and ideas
- add new vocabulary to the word wall
- categorize and label web topics
- design questionnaire on musical instruments in the home
- find out how to present survey material

- interview music experts
- listen in large or small group discussions
- report progress at large group

*formulating questions (B-7c)
- develop questions to ask experts
- develop researchable questions
- reflect on questions at the end of the project

*integrating new vocabulary (B-7d)
- add new vocabulary words to the word wall
- brainstorm and web ideas
- use new vocabulary during the project

*making lists (B-7d)
- make lists of instruments we have seen
- make lists of materials needed for representations
- make lists of questions to be asked
- make a list of songs students have learned
- make vocabulary list
- make lists of who they want to interview
- make lists of what we have learned

*planning (B7-a, B-7c, B-8)
- develop "disco room" atmosphere
- develop list of instruments for mural
- develop list of instruments for questionnaire
- draw rough draft for mural

*presenting (B7-d)
- explain what we've learned about instruments at culminating activity
- share personal memory stories with the class
- share progress on each step of project

*reading (B-7d)
- brainstorm "what I know now"
- create a list of instruments and people that visited
- dictate memory stories
- dictate "what I've enjoyed about music project"
- read books about music to the class
- read experience stories at group
- read words to the songs we sing
- reflecting (B-7g, B-7d, B-7c)
- respond to literature through discussion at large group

- using references and resources

Investigative Skills-Science

*exploring (B-7)

- explore the questions such as:
  - What is the relationship between music and movement?
  - What instruments make up an orchestra?
  - How are musical videos and songs produced?
  - What is the relationship between sound and music?
  - What is rhythm?

*experimenting (B-7c)

- answer questions:
  - What makes sound?
  - How do we hear the instruments?
  - Which bell is the highest pitch?
  - Which is the lowest?
  - Can you place the bells in order of lowest to highest?
- change the level of the water to vary the sounds
- make a telephone out of string and paper cups
- place different materials in shakers to explore the different sounds

*investigating (B-7c, B-7d)

- How does a piano make sound?
- How do you play a French horn?
- How do you play a guitar?
- Which glass has the lowest sound?
- Which glass has the highest sound?
- What sounds do we find in the classroom?
- What sounds do we find on the playground?
- Who is in charge of the orchestra?
- Why do cellos have sticks?

*observing (B-7c)

- observe and list the sounds heard in the classroom
- observe and list the sounds heard outside
- observe a piano that is being repaired
- observe how a guitar is strummed
- observe the slinky as it moves
- observe water waves when the glass is tapped

*predicting (B-7c)

- predict possible answers to questions formulated before talking to an expert

- predict results prior to conducting an experiment
- predict the number of players in an orchestra
- predict what instrument is in the case
- predict which sound will be low and high in the glasses

*reporting (B-7c)
- report progress on representations
- report results of experiments to large group

Numeration and Problem Solving

*counting (B-7c , B-7d, B-8)
- count number of members in each musical group that visited
- tally results from questionnaire

*estimating (B-7c)
- estimate how many people will be in the percussion group
- estimate how many people will be in the string quartet
- estimate how to make the sound higher in the cup of water
- estimate how to make the sound lower in the cup of water

*measuring (B-7c)
- measure the length of the instruments
- measure the length of the instruments using non-standard measurement
- measure the pipes of the organ and place them in order
- use measurement to build the pipe organ

*organizing, analyzing and communicating data (B-7c, B-7d)
- develop bar graphs to display the result of questionnaire on instruments
- write a paragraph explaining results of the questionnaire

*surveying (B-7c, B-7d)
- Do you have a violin at home?
- Do you have a guitar at home?
- Do you have a trumpet at home?
- Do you have a flute at home?
- Do you have a drum at home?

Social, Emotional Growth and Dispositions

*communicating (B-7b, B-7d)
- ask questions skillfully
- engage in group discussions

- listen to others
- negotiate roles, turn-taking, problem solving
- report progress of investigations to the group
- share research
- use new vocabulary

*cooperating and collaborating while working with others (B-7c)

- create shakers and instruments by helping one another with tape or glue
- create the pipe organ and put it together
- follow directions of conductor
- study in teams collaboratively
- write music and perform together

*empathizing with others and their needs (B-7b, B-7h)

- appreciate work of peers by noting effort, care in work and originality
- share materials, space and time
- share words of encouragement and appreciation of peers

*enjoying (B-7a)

- listen to the different instruments and gain new appreciation of sound
- listen to various CDs brought in by peers
- perform together as an ensemble

*gaining confidence in abilities to do the following (B-7a)

- investigate
- make presentations to an audience
- observe and draw the details of an instrument
- represent instruments using plasticine and play-dough
- use a variety of mediums to express ideas about instruments

*helping peers (B-7b)

- discuss problems for better understandings
- joint clean up of areas
- problem solve when creating instruments
- represent instruments, music

*initiating (B-7a)

- choose appropriate materials
- experiment with sound and instruments
- predict and manage time
- research to find answers to questions

*persevering (B-7a)

- adding each detail to observational drawing
- creating instruments that hold together

- working on ensemble until conductor likes outcome
- writing music until the song is finished

*problem solving (B-7c)

- find a way to stop leaks in shakers
- how to make a high pitch and low pitch with water levels in glass
- how to place the pipe organ from lowest to highest pipe
- who participates in each ensemble

*risk taking (B-7a)

- lead other children in an ensemble
- play instruments in front of a group
- state disagreements in conversations or at group meetings
- support opinions
- verbalize estimations, predictions and hypotheses

Studying Music

Preschool Classroom

Relationship of Project Activities to NAEYC Accreditation Criteria

Standard B: Curriculum	
4. Daily schedule provides a balance of activities in consideration of the child's total daily experience.	**B-4a.** All age groups play outdoors daily, permitting conditions protect children's health and safety. **B-4b.** The schedule provides for alternating periods of quiet and active play. **B-4c.** A balance of large-muscle/small-muscle activities is provided in the daily schedule. **B-4d.** More than one option for grouping (such as individual, small group, or large group) is available to children most of the day. Infants and toddlers are not expected to function as a large group. **B-4e.** A balance of child-initiated and teacher-initiated activity is provided. The amount of time spent in large-group, teacher-initiated activity is limited.
5. Materials and equipment are appropriate to the age group.	**B-5a.** Materials and equipment appropriate to the age group (including books, dolls, toys, dress-up props, photos, pictures, music) that project diverse racial, gender, and age attributes are provided. • Materials reflect the lives of the children and families served. • Materials and equipment reflect the diversity found in society in general. **B-5b.** Developmentally appropriate materials and equipment are available for *infants*. • Simple, lightweight, open-ended, easily washable toys such as containers, balls, pop-beads, nesting cups • Rattles, squeak toys, action/reaction toys • Cuddle toys • Toys to mouth such as teethers, rings • Pictures of real objects • Crawling area with sturdy, stable furniture to pull up self **B-5c.** Developmentally appropriate materials and equipment are available for *toddlers*. • Push and pull toys • Manipulatives such as stacking toys, large wooden spools/beads/cubes, pounding bench, simple puzzles • Sturdy picture books, music

	• Toys for pretending, such as play telephone, dolls • Large paper, crayons • Sturdy furniture to hold on to while walking • Sand and water toys **B-5d.** Developmentally appropriate materials and equipment are available for *preschoolers*. • Active play equipment for climbing and balancing • Unit blocks and accessories • Puzzles, manipulative toys • Picture books, audio recordings/tapes, musical instruments • Art materials such as finger and tempera paints, crayons, safe scissors, and paste • Dramatic play materials such as dolls, dress-up clothes and props, child-sized furniture, puppets • Sand and water toys **B-5e.** Developmentally appropriate materials and equipment are available for *kindergartners*. • Active play equipment for climbing and balancing • Unit blocks and accessories such as figures, signs, cars, trees • Construction materials • Complex puzzles and manipulative toys for counting, sorting • Picture books and early readers • Audio recordings/tapes, musical instruments, computers with appropriate software • Materials for writing and complex art projects • A variety of dramatic play materials and props • Board and card games **B-5f.** Developmentally appropriate materials and equipment are available for *school-agers*. • Active play equipment and materials such as bats and balls for organized games • Construction materials for woodworking, unit blocks, accessories for blocks • Materials for hobby and art projects, science projects • Materials for dramatics, cooking • Books, audio recordings/tapes, musical instruments, computers with appropriate software • Board and card games • Complex manipulative toys (connecting or interlocking toys), jigsaw puzzles
6. Active media used in classroom.	**B-6a.** Active media that children can control, such as videotaping, cameras, audiotaping, and developmentally appropriate computer software may be used in the classroom as active learning materials, along with other materials that children can choose. If such technology is used, the program provides equal access for all children. Teachers help children use these media as independently

	as possible. *(This criterion applies to children 3 years of age and older; it is not applicable to infants and toddlers.)* **B-6b.** The use of passive media, such as television, films, videotapes, and audiotapes is limited to developmentally appropriate programming. • Programs are previewed by adults prior to use. • Another option for activity is always available. • No child is required to view the program. • Teachers discuss what is viewed with the children to develop critical viewing skills. • Passive media are used only as infrequent events, rather than as regular, daily routines.
7. Teachers provide a variety of developmentally appropriate activities and materials that are selected to emphasize concrete experiential learning and to achieve the following goals:	**B-7a.** Foster positive identity and sense of emotional well-being. **B-7b.** Develop social skills. **B-7c.** Encourage children to think, reason, question, and experiment. **B-7d.** Encourage language and literacy development. **B-7e.** Enhance physical development and skills. **B-7f.** Encourage and demonstrate sound health, safety, and nutritional practices. **B-7g.** Encourage creative expression, representation, and appreciation for the arts. **B-7h.** Respect cultural diversity.
8. Teachers provide materials and time for children to select their own activities during the day.	**B-8.** Teachers provide materials and time for children to select their own activities during the day. • Infants and toddlers have objects and materials for free choice. • Several alternative activities are available for children's choice. • Teachers respect the child's right not to participiate in some activities. • Teachers pick up on activities that children start or interests that children show. • Kindergartners and school-agers help prepare materials, plan and choose their own activities at times during the day.
9. Teachers conduct smooth and unregimented transitions between activities.	**B-9.** Teachers conduct smooth and unregimented transitions between activities. • Children are given advanced notice to prepare them for transitions ahead of time. • Children are not always required to move as a group from one activity to another.

	• The new activity is prepared before the transition from the completed activity to avoid prolonged waiting. • School-age children help plan and participate in the change of activity, have time to adjust to change from school to program.
10. Teachers are flexible enough to change planned or routine activities.	**B-10.** Teachers are flexible enough to change planned or routine activities. *For example,* Staff follow needs or interests of the children. Staff adjust to changes in weather or other unexpected situations in a relaxed way without upsetting children.
11. Routine tasks are incorporated into the program as a means of furthering children's learning, self-help, and social skills.	**B-11.** Routine tasks are incorporated into the program as a means of furthering children's learning, self-help, and social skills. • For infants and toddlers, routines are used as a time for pleasant interaction and learning. • Routines such as diapering or toileting, eating, dressing, and sleeping or resting are handled in a relaxed, reassuring, and individualized manner based on developmental needs. • Teachers plan with families to make toileting, feeding, and the development of other self-regulation skills a positive experience for children. *For example,* Respect infants' individual sleeping schedules; provide alternatives to preschoolers who are early risers; offer kindergartners choices or permit preferences whenever possible; provide school-agers with a place to rest if they choose; respect school-agers' increasing interest in personal grooming.

Who Measures What in Our Neighborhood?

K-1 Classroom

Table of Contents

Who Measures What in Our Neighborhood?

K-1 Classroom

Project Objectives

There are two different types of objectives articulated and identified in this project entitled, *Who Measures What in Our Neighborhood*. General objectives for project-investigations are common across all topics. They are aligned with best practices and high quality curriculum as described by the National Association of the Education of Young Children and the National Association for the Gifted. General objectives reflect the process of inquiry and the students' engagement in in-depth studies.

Specific content objectives for each project investigation emerge initially out of topic webs and are formulated and reformulated by the students' questions, the teachers' guidance, and the shifting interests of the students as the project progresses. The degree to which a child experiences depth and complexity of a topic may be different depending upon the diversity of skills and abilities of the students. Not all children master each objective, but respond to the tasks and progress at their own level. Outcomes are varied and children demonstrate different levels of content and skill mastery. General and specific objectives relate to the Illinois Learning Standards for early elementary students.

General Objectives for Project Investigations

1. Students will engage in an in-depth study of a topic.
2. Students will pursue first hand investigations.
    - Students will engage actively in data collection.
    - Students will become more proficient in organizing data.
    - Students will learn and utilize different modes for representing data.
3. Students will think critically and reflectively.
    - Students will engage actively in discussions of the topic, exchange ideas, debate, etc.
    - Students will formulate questions.
    - Students will evaluate their experiences in many ways and participate in culminating activities.
4. Students will relive and renew experiences they have had with various subject domains.
5. Students will increase their ability to use primary and secondary resources.
6. Students will increase their vocabulary.
7. Students will learn and apply new modes of inquiry including questioning and hypothesizing, reforming of hypotheses, interviewing, surveying, and observing.
8. Students will increase their modes of representing their ideas (observational drawings, graphs, Venn diagrams, displays).
9. Students will uncover facts and principles in various subject domains.
10. Students will be exposed to numerous and varied instructional strategies such as the following:
    - Whole group instruction and discussion
    - Small group instruction and discussion

- Interviews with experts
- Field trips
- Field studies
- Student-initiated projects such as constructions, surveys, representations
- Personal conversations with teachers or other student experts
- Experimentation

11. Students will strengthen their dispositions to be interested in relevant and worthwhile phenomena.

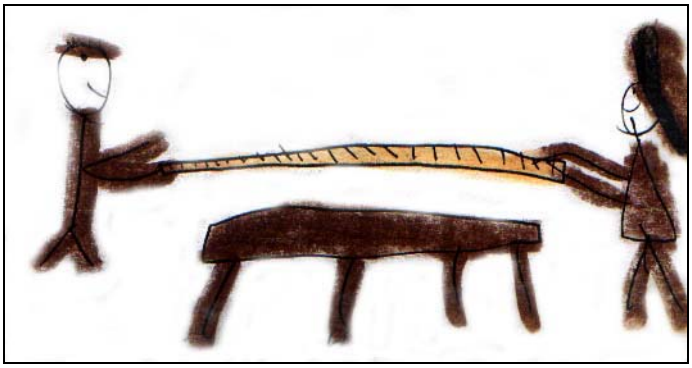
Specific Content Objectives for *Who Measures What in Our Neighborhood?*

1. Students will gain awareness for why people measure.
2. Students will gain in their understanding of the importance of measurement for answering questions, data collection, and scientific investigations.
3. Students will become familiar with measurement in many fields of study.
4. Students will distinguish between standard and non-standard measurements.
5. Students will increase their understandings about various measuring tools and how they work.
6. Students will gain a vocabulary of measuring tools and instruments.
7. Students will become more competent with using measuring tools.
8. Students will become familiar with many things in their lives that can be measured.

Who Measures What in Our Neighborhood?

K-1 Classroom
January – May 2002

Overview



Beginning the Project

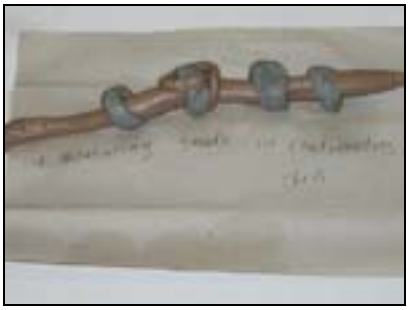
Students in the K/1 classroom at University Primary School became interested in measuring during their investigation of their environment in the fall. During their project entitled, *Keeping our Environment Healthy*, students measured the amount of litter they collected on their playground and the amount of trash from their lunches. Noticing their increased interest in measuring things, and the multitude of authentic opportunities to measure, the teachers chose the topic of measurement for the spring semester. This investigation entitled, *Who Measures What in Our Neighborhood?* not only presented a context for learning many of the basic skills in the math curriculum at University Primary School, but it also met many of the Illinois State Learning Standards in mathematics and science for this age level.

Project work encourages a variety of opportunities for children to make choices, work in informal groups, think about ideas, ask questions, and research to find answers. These opportunities allowed portals for teachers to see children in different venues to learn more about individual dispositions and abilities. In the first phase of a project the teacher focuses on finding out what the children already know about the topic.

The head teacher began the project by sharing stories of the wall in her house where all family heights were recorded. The children shared many stories about being measured by a doctor and measuring to build things. They chose ways to represent measurement that included drawings, surveys, Kid Pix graphics, and models of measuring tools using clay, Legos, blocks, rods, or boxes and junk. The teacher and class brainstormed words associated with measurement that were categorized to form a web. Students had questions about the ideas they generated. Teachers used their questions to guide the students in inquiry:

1. What tools are used for measuring?
2. How do measuring tools work?
3. What things get measured?

4. How do you measure with measuring tools?
5. Why do we measure?
6. Who measures what in our neighborhood?



A student's clay memory representation of a measuring tool

A student's misconception of how he would measure a window.

Developing the Project

The children engaged in field studies and listened to experts answer their questions. Field studies included several neighboring sites: Children's Research Center, Illini Credit Union, ceramics studio, Fire Service Institute, State Water Survey, and sheep farm. Visitors included a mechanical engineer, and a food inspector. Parent experts included an animal researcher, a potter, a pilot, a seamstress, and a father who brought his car to show the children what you measure in a car. In addition, two science undergraduates from the university conducted measurement experiments with small groups of students.

Before each field trip, students predicted what they might see. During field studies the children collected data in various ways. They collected artifacts, made observational sketches, took photographs, counted and tallied, and wrote answers to their questions that they asked the tour guides.

After returning to the classroom, students made representations of some of the measuring tools that they had seen on their field studies. Writing opportunities included experience stories, letters, poems, books, and writing captions for their drawings. Students completed and discussed results of surveys. They compared and organized their findings into charts, and graphs. At large group meetings, students listened, questioned, and commented about each other's work. In this social context, they gained new understandings about measurement that were documented throughout the project.

Students view the gauges on the fire truck.

Students see the different sizes of ladders used for different buildings.

Concluding the Project

The children culminated and shared what they had learned through an informal open house with parents and the preschool classroom next door. Students brainstormed what they had learned about who measures what in the school neighborhood. The teacher gave a survey to parents to find out what they thought their children had learned about measurement. To get ready for the open house, students reflected about what they had learned on a survey, and created a PowerPoint presentation to share their understandings of measurement. Themes emerged and groups of children chose to create murals and write reports to share their new information. The mural topics included:

Measuring is important for making things the way you want.
Measuring is important for good health.
Measuring is important for making maps and globes.
Measuring is important for finding out what is heavy and what is light.

They also applied their new measurement skills of using rulers and comparing sizes and proportions to create their three-dimensional models and representations that displayed what the class had learned about measurement.

Students represent the fire truck that they saw on their trip to the Fire Institute.

Students display their completed fire truck at the open house.

What did the Children Learn?

Through the in-depth study of *Who Measures What in Our Neighborhood?*, the children gained awareness that measurement is a part of everyday life. They became more skillful in framing questions and using measurement terminology in conversation. Their vocabulary extended beyond the typical measurement words in kindergarten and first grade mathematics curriculum. In addition to rulers, scales, and tape measures, students learned about specific types of scales including spring scales, and balance scales. They also learned about trundle wheels, balers, coils, and calipers as tools people use to measure items in various professions.

They became more comfortable using measuring tools and measuring for their own purposes. They used digital photographs to represent measuring tools and their experiences accurately in their drawings and 3-dimensional structures.

Most students listened to each other, shared comments, and discussed their views with others. Many students articulated difficulties working on a team product. They met and often exceeded Illinois Learning Standards by using graphic organizers to analyze and draw conclusions from their data. They gained an appreciation for the complexity of the term measurement.

Students create a mural showing that measuring is important for making maps and globes.

Students display their mural at the open house.

Who Measures What in Our Neighborhood?

K-1 Classroom

Phase 1

How long is the carpet?

How deep is the puddle?

Teachers planned for the project by brainstorming major concepts and big ideas that they felt were essential for students to understand. These big ideas included:

1. Most people measure in their daily lives.
2. There are many different types of measuring tools.
3. Many things in our surroundings need to be measured.
4. Measurement is essential to finding answers in many fields of study.
5. There are standard and non-standard units of measurement.

Teachers made a topic web of possible avenues of exploration that included activities, field trip sites, experts, resources, required curricular objectives and basic skills. Teachers used their topic web as a resource for the project investigation. They provided the materials and resources for students to find answers in their areas of interest.

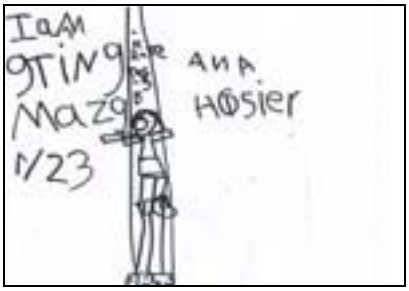
In the classroom, the project began when children remembered the fall project entitled, *Keeping our Environment Healthy*. The children recalled that they took measurements when they collected data. They remembered weighing the litter from the playground and the nearby pond. They also remembered weighing the garbage generated at lunch at the beginning of the project and compared it to the weight of the garbage from their lunches at the end of the project.

The teacher recorded their recollections of their experiences with measurement on 'post-it' notes and began the Student Measurement Topic Web 1. In small groups, students revisited their ideas and explained them further to categorize them. The teacher helped students categorize their ideas by asking them to listen for similarities. The discussion of how their ideas were similar to others' enabled the teacher to note and document students' current understandings and misunderstandings.

The teacher is telling children to categorize by similarities.

To encourage students to think further about their previous experiences with measurement, teachers shared personal stories. The head teacher described a special wall in her kitchen that recorded heights of all the family members. Several children told of their experiences with measuring. Children wrote and drew about their personal experiences.

"My grandma measures me to make my clothes."



"I am getting measured."

Their pictures were photocopied and revisited so that students could form groups with peers who had similar experiences. The following conversation occurred during the sorting process of their memory drawings.

NO: I drew my dad measuring a piece of wood so he could build my clubhouse.
WJ: I think mine should go with NO's because my dad is measuring to build a deck.
BK: My dad had to measure pieces of wood for building a climber in our back yard. My picture should go with NO's too.
JK: My picture shows when I was a baby I got measured and weighed. My picture could go with NO's.
BK: No. Yours isn't about measuring how long something is.
JK: Yes. See here is the ruler to see how long the baby is.
BK: But you also said weight.
DM: That's the same – measuring for a clubhouse and weighing a baby. I have a baby brother and he gets weighed.
AB: Yeah.
NO: Weighing babies and measuring wood is not the same. They should not go together in my category.
JK: I think it should go together.

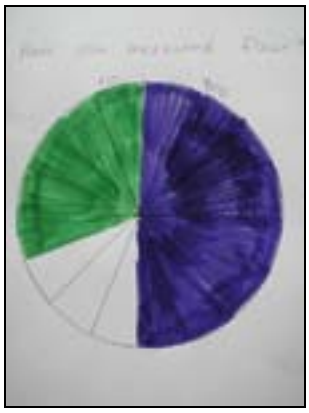
Students discuss how to categorize their memory drawings.

Graphic representation of their categories of their memories about measurement.

Students were curious about the experiences of their peers. Many students developed questionnaires to poll their classmates:

KC: Have you been measured for making clothes?
WJ: Have you measured a deck?
BK: Have you measured pieces of wood?
CW: Have you ever measured from your chair to your daddy's chair?
VM: Have you been weighed at the doctor's?
AB: Have you been measured for new shoes?
PJ: Have you been measured on a scale?
BH: Have you been measured for how tall you are at home?
JK: Have you been measured when you were a baby?
AH: Have you been measured against a wall at home?
LS: Has your mom measured you to see how tall you are?
AC: Have you been measured for making a costume?
ST: Have you been measured for how tall you are at the doctor?
NB: Has your height been measured at the doctor?
HB: Have you measured flour?
TB: Have you got yourself measured with a stick?

Questionnaire asking classmates, "Have you measured flour?



Pie graph showing the number of students who had and had not measured flour.

During large group discussion, several students mentioned problems they had while measuring something. The teacher asked students with similar problems to get together in small groups to discuss the difficulties they had measuring.

Students discuss what is difficult about measuring solids.

Students discuss what is difficult about measuring the length of things.

The comments from the group discussing solids included:

WJ: It's hard measuring the depth of wood.
LS: It's hard measuring what is solid.
VM: It's hard measuring salt because it is so, so, so, so little.

One group discussed measuring the length, width and height of things.

AC: Sometimes you need a big measuring ruler that's really tall.
BH: You have to read hard numbers.
BK: The tape measure isn't always long enough.

Another group discussed difficulties they had weighing things.

KW: We couldn't weigh all the garbage.
ST: I didn't know what to measure with.
JN: How do we measure something light like a pencil?
JC: Some things fall out of the weighing cups because they are too big or too round.
NO: How do you weigh something really heavy like a bowling ball?

Another group discussed difficulties they had had in measuring liquids. These discussions helped students develop a fuller understanding of their experiences.

They drew pictures and made models of measuring devices with clay, Legos, rods, blocks and boxes and junk. During this phase as they recalled and explained, examined, defended and debated their experiences, questions arose. Teachers talked with individuals to clarify their questions and helped them to articulate what they wanted to know.

One student asked, "How do you measure the computer?" The teacher responded by asking for clarification, "What is it that you want to know about the computer? Do you want to know how tall the computer is? Or how heavy the computer is? Or how the computer can help you measure?" The student replied, "I want to know how tall is the computer?"

Another student asked, " How do you make measuring tape?" The teacher responded by asking him if he wanted to see how one worked or how to make one?" The student answered, "How do you make a measuring tape work?"

VM inquired, "How do you measure cars?" The teacher asked, "Do you want to know how long and how tall and how wide a car is to see if it will fit in a garage or what kind of measuring does a car tell the driver?" VM said he wanted to know what kind of measuring does a car tell a driver. For MW's question, "How far does the USA go," the teacher asked, " Do you want to know the longitude and latitude on a map or the area covered by the US?" MW said he wanted to know about longitude and latitude.

Teachers used the students' questions and their categories to form smaller study groups. Teachers grouped some individual questions under broader researchable questions.

Questions

What tools are used for measuring?

How do measuring tools work?
WJ: How do you make a measuring tape work?
JN: How do scales work?

What things get measured?
LS: How do they measure a TV? Do they put it on a scale?

JC: How tall are you?
HB: How do you measure wood? I think they tape measure.
TBP: How do people measure the parts in a computer?
BH: How do you measure cars to make a car?
KC: How do you measure wire?
MW: How far does the USA go? (longitude and latitude)
NB: How do you measure how long a planet is? On a globe?
PJ: How tall are computers?

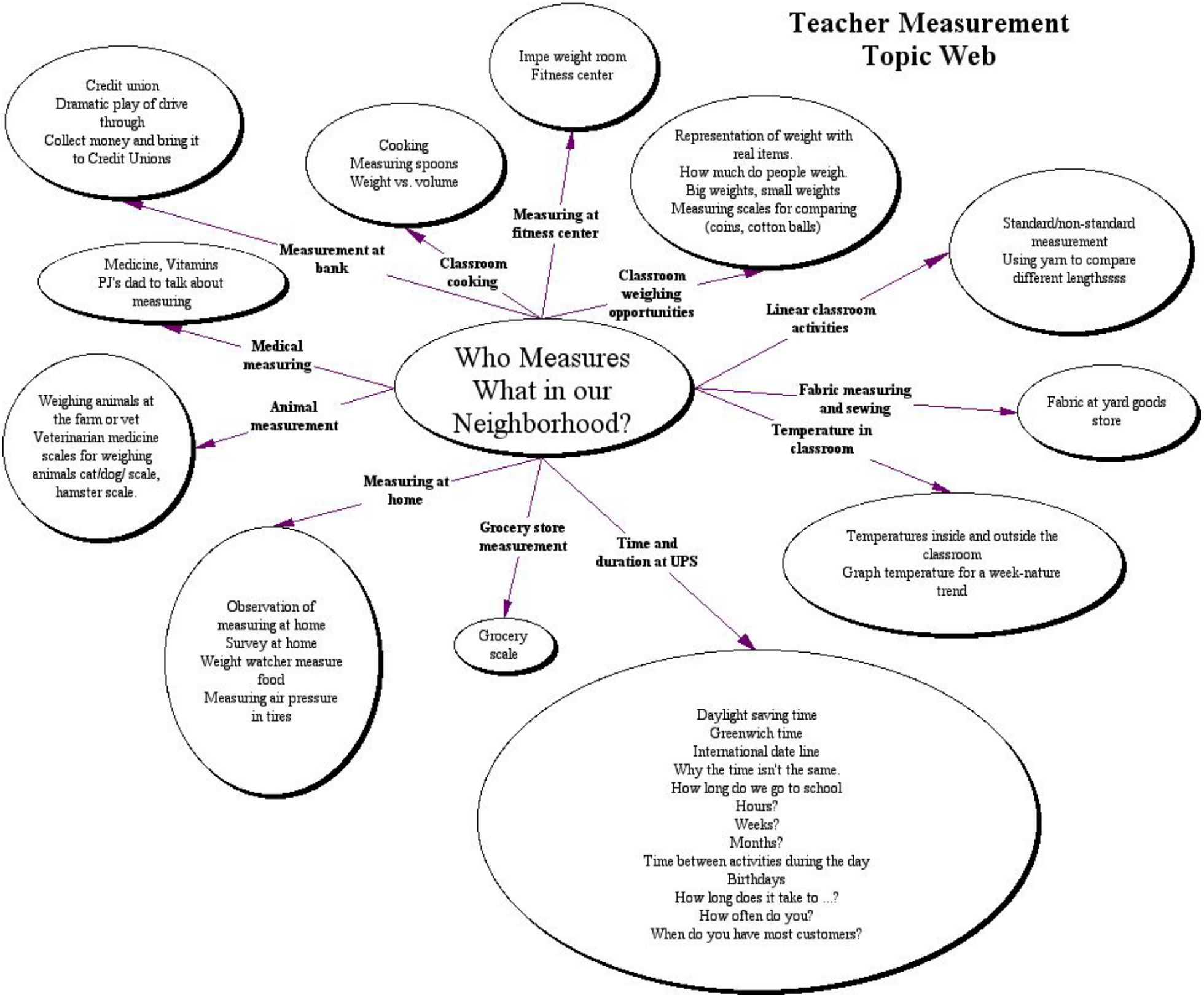
How do you measure with measuring tools?
AC: Why sometimes it is hard to measure with a ruler?
SD: How many people can fit across the USA?

Why do we measure?
KW: Why do we have to measure?

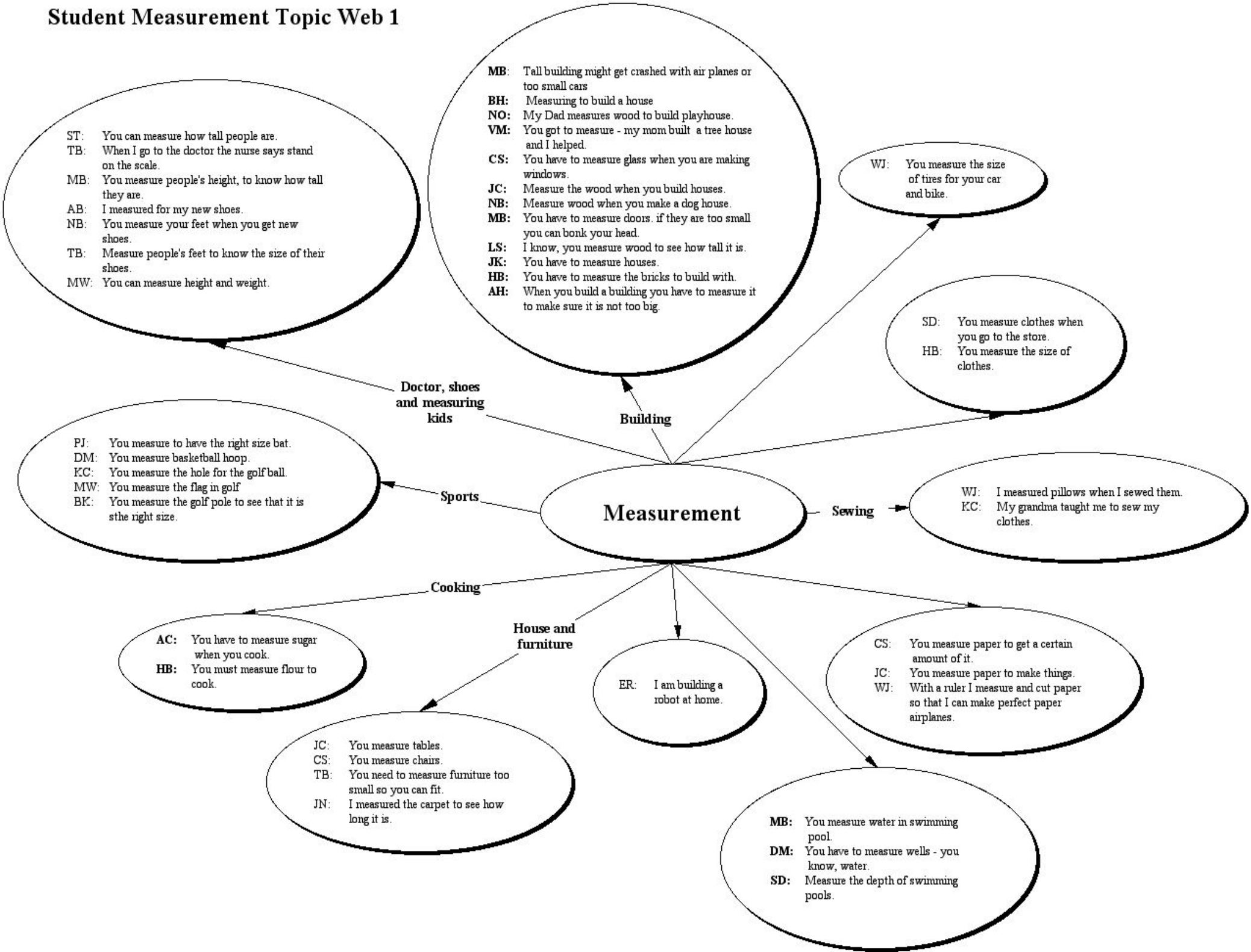
Who measures what in our neighborhood?
CS: What does the Fire Institute measure? My guess is they measure hoses.
BK: What do people use for measuring water?
JK: Is the preschool still measuring wood?
VM: What kind of measuring does a car tell the driver?

The teachers guided the individual and small groups of students in researching their own questions. The entire class focused on the main question, "Who measures what in the neighborhood?"

Teacher Measurement Topic Web



Student Measurement Topic Web 1



Who Measures What in Our Neighborhood?

K-1 Classroom

Phase 1 Photo Gallery

AC remembers and draws when her ballet teacher measured her for the recital.

BK's memory drawing says, "My dad is measuring the pieces of wood for the climber and how far they are from each other."

"We measured the chair last year."

"You have to measure the basketball hoop."

"I am measuring flour."

"I helped measure the deck."

SD explores the room with a tape measure.

A small group gathers to discuss their experiences with liquids.

Who Measures What in Our Neighborhood?

K-1 Classroom

Phase 2 - Inquiry

Pursuing Our Questions
Data Collection, Analysis, and Synthesis, and Evaluation

The meteorologist explains the thermometer and barometer inside the box.

The students make field sketches of an anemometer.

Once the students formulated questions for measurement in Phase 1, Phase 2 began with the students investigating and gathering data to answer their questions. The students gathered data by going on field trips (site-visits), exploring artifacts first-hand, interviewing experts, observing, using the Internet, reading books, and designing questionnaires. They recorded their data by sketching, drawing, taking notes, videotaping their experiences, and taking photographs. They always predicted what they might find or see before their field visits and before they spoke with the experts so they could compare their current understandings with what they had learned. They, observed, hypothesized, theorized, tested, analyzed, and evaluated their data. They shared their findings at group meetings. Parents shared their expertise, answered surveys, and contributed related artifacts for study.

Field Work

What tools are used for measuring?

To begin to answer their question, "What tools are used for measuring," students gathered measuring tools from home and around the school. The teachers wanted students to gain awareness that measurement takes place at school and at home. The first place students "visited" was their own classroom. They continued to explore the measuring tools in the classroom for five months!

Their collection of artifacts that were either measuring tools or involved the use of measuring included teaspoons, measuring cups, trundle wheel, watches, clocks, a quilting template, a sewing machine, yard sticks, a fabric cutting board, antique spring scale, balance scale, doctor's scale, a bungee cord, several different thermometers, money, calibrated weights, tape measures, an oil stick, and a tire air gauge. They also found that people use body parts and other non-standard units as reference points to measure. They compared standard to non-standard units.

Using non-standard measurement
to measure the length of the floor.

One child announced to the class that his gerbil had babies. He told them how he measured the babies with his finger and the other students questioned his measuring technique.

JN: My gerbils had babies before I came to school today. I put my finger beside one of them and its body AND tail was as long as my first finger to the knuckle.
MW: Why didn't you put a ruler in to measure?
JN: Oh... The mom wouldn't have liked that. My mom said that I could bring them to school to show you when just the body is to the knuckle of my first finger – not including the tail.

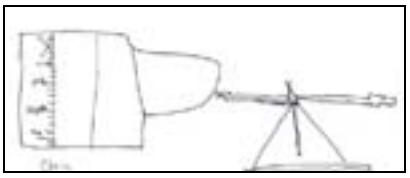
JN shows the students
how big the gerbils were
compared to his fingers

Students use a ruler to
measure the snow.

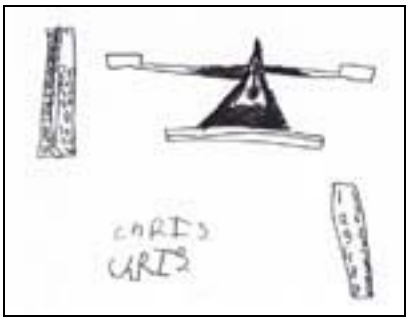
Throughout the project students used standard and non-standard measurements and learned to distinguish them.

How do measurement tools work?

As students measured, they observed closely and investigated, how the measurement tools worked. They made time 1 and time 2 observational drawings of items of interest.



Time 1 Drawing – 3/15/02
CS looks at measuring tools and makes an observational drawing of a



Time 2 Drawing – 3/27/02
CS makes a more detailed drawing of the balance

The purpose of doing a second observational drawing was to increase their ability to observe carefully and integrate more details into the drawings. In measuring long areas with a ruler, students practiced working with a partner to put their finger at the end of the measuring tool and then advance the ruler.

A mechanical engineer helped answer questions generated during phase 1, "How do you make a measuring tape work, and how does a scale work?" He showed the mechanism inside the measuring tape that makes it return when the button is pushed. He demonstrated how the spring scale bounces back by putting a bungee cord next to a ruler. He distinguished between different types of scales and explained the way the fulcrum works in a balance scale that measures heavy items. He showed a food and stamp scale used to weigh light items. He also answered, "How do you measure a TV and computers, and how do you measure wood, and wire?"

The engineer explains the way the balance scale works.

What things get measured?

To answer the question, "What things get measured," the students used their collection of measuring tools to measure items found in the classroom including themselves. They predicted and recorded what they thought the measurement would be and then preceded to measure.

They found and measured the following:

- Each other's height, weight
- Parts of body: circumference of waist, knee, wrist, ankle, neck, head, etc.
- Chicks: height and weight
- Carpet length: feet – standard, non-standard
- Room length, width, and area – standard, non-standard
- Ceiling to floor – comparison of each room
- Books
- Papers
- Pencils, markers, staplers, and crayons
- Weighed:
  - 100 pencils
  - 100 crayons
  - 100 beans
  - 100 graham crackers
  - Chicken feed
- Length of window standard, non-standard
- Tables and chairs – height, length, width - standard, non-standard
- Measured ingredients, time and temperatures to cook
- Depth of snow
- Depth of rain puddle
- Costumes
- Days to an event – chicks hatching
- Number of chicks hatched
- Amount that the chicks ate, drank and spilled
- Size of playground for an obstacle course
- Plastic animals
- Blocks
- Computers
- Wood
- Wire
- TV

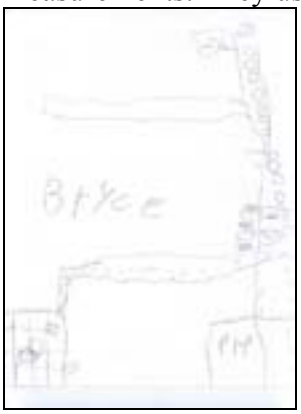
MW measured DM while she tried to stand very still.

KC measured the length of the plastic animals on the toy shelves. Her data shows

Why do we measure?

All through the project, students discussed the question, "Why do we measure?" They realized that they use measurement in all aspects of their day. For example, they checked the thermometer to determine whether they could go outside and what to wear for recess. Their understanding of temperature expanded with the concept of wind chill. Students asked the teacher daily if the temperature was above 20 degrees so they could go outside for recess. They asked for the wind speed and direction as well. Together the teacher and students read the thermometer on the playground and verified their findings by checking the weather service on-line. Students recorded the daily temperature and graphed it daily for a two-week period.

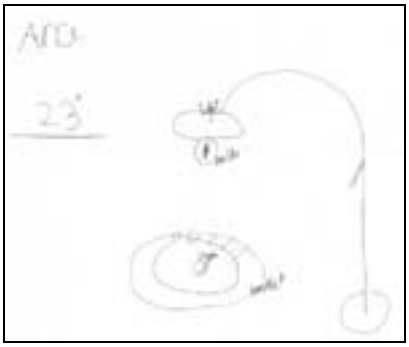
In preparation for the annual art exhibition at University Primary School, a group of students paced their steps to map out a course for parents to follow and drew a map using their measurements. They used a stopwatch and trundle wheel to design an obstacle course.



BK counted his steps down the hall and to the art exhibit and made this map.

AC practices using a trundle wheel to measure the length of the floor.

The teacher provided an additional context to consider reasons why people measure. On April 23rd, students counted two-dozen eggs and predicted what conditions they thought eggs would need to hatch.



AH predicted that the chicks will hatch in a basket with a light bulb at 23 degrees.

HB predicted the habitat for hatching eggs should be a cushion with a light bulb at 10 degrees.

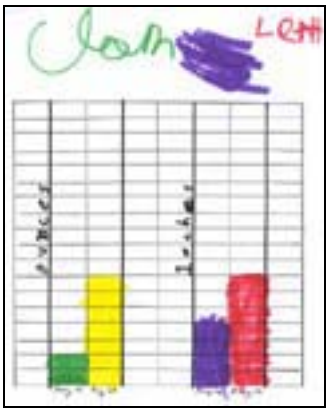
The teacher introduced the incubator as the habitat for keeping the eggs warm. After school, she placed the eggs in the incubator. Throughout the incubation period, students measured the temperature of the incubator by checking the thermometer inside of the incubator. They kept track of the incubation period by marking days off on the calendar. While waiting for the chicks to hatch, students cooked with eggs and experimented with measurement. They made meringue cookies and beat egg whites until they were stiff. The animal scientist explained that when they beat the egg whites, they trapped air inside and the egg whites became fluffy and bigger than their original liquid state. They noticed with the air trapped in the egg whites that it took more room in the measuring cup. Then they wondered if egg yolks when beaten would also take more or less room in the measuring cup than egg whites. They conducted their own experiments.

HB studied the incubation calendar made by a first grader.

JK studied the egg yolk experiment.

Once the chicks started hatching, they counted many times a day the number of chicks that hatched, watched the thermometer in the brooder box and measured the space in the brooder box to make sure there would be enough area. After the 16 chicks were 24 hours old, they were strong enough to be held. The students recorded their growth daily by measuring their height and weight and by making observational drawings.

The assistant teacher holds the chick on the scale while KC reads the weight.



LS graphed and compared the weight and height of one chick from the second day of birth to the last day of school.

Students also recorded the amount of food and water the chicks ate. The chicks drank and spilled a pint of water in the morning and another one at night the first week. The second week, they drank a gallon of water morning and night. The children thought five pounds would be enough food. The chicks finished five pounds in one week. The next size feed bag was 50 pounds that cost $8.90. The chicks had eaten approximately half of the food by May 30, the last day of school. This was more than the students predicted they would need to feed the chickens. Taking care of the chickens provided authentic opportunities for students to use measurement tools and to understand the importance of measurement.

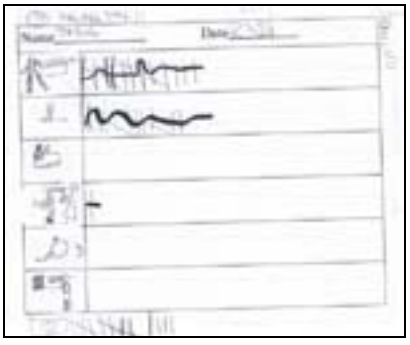
Who measures what in our neighborhood?

Students had a solid grasp of all of the measurement that takes place in the classroom and wanted to explore their question from Phase 1, "Who measures what in our neighborhood?" First, they predicted all the ways they thought people measured in and around the school building.

Predictions	How many saw it
Paper being measured	11
Measuring how much fish food	0
Measuring juice for snack	0

Measuring seeds so that you know where to put them	0
Measuring work - counting papers	0
Measuring wood	0
Measuring to cook something	9
Measuring wells for water	0
Measuring how much popcorn for snack	0
Measuring light bulbs	0
Measuring pond water	0
Measure food for right amount for all kids	1
Measure granola bars (how much they weigh)	9
Measuring to make sure that lights last for the day	0
Measure how tall we are	3
Measure the playground	0
Measure water for plants	0
Measure how many papers she worked on	1
Measure how far they can walk	0
Measure chairs to see how big they are	0
Measure the lines on paper	11
Measure to see if it is safe for a tree to be cut	0

Each child selected one of the items from the list to draw. The teacher used their drawings to make a sheet for data collection. Students walked around the Children's Research Center, the building that houses University Primary School, and made tally marks on their recording sheet every time they saw someone measuring or a measuring device. Later, the children analyzed the data that they had collected on their tally sheets. They interpreted the information and made a bar graph to show what they had seen. They communicated the results to the teacher and noted some mathematical relationships. During these individual conferences, the students noticed that they had not predicted very many of the items that they saw. Consequently, they had to draw a quick sketch of what they were seeing in the margins and tally mark there.



JC tally sheet indicates items that she saw on her tour around the school.

JC graphed her data for other students to see.

The teacher took the students on a walk around the outside of the school. The students were curious to know if people were measuring in the nearby buildings. Some students had knowledge of neighboring sites from last year's studies about communication and construction. To add to the students' common experiences, the teacher and her assistants planned a whole group field trip to the neighboring Atmospheric Environment Section of the State Water Survey and to the Fire Service Institute.

In early March, the students wrote questions for a meteorologist at the State Water Survey. They predicted how they thought he would answer their questions.

	Questions	Predictions	Findings
AH:	How do you know the temperature?	I think you go out and guess.	The meteorologist has a lot of machines to help. He has a rain gauge and a board with a flag on it.
NB:	How do you measure the weather?	Well, we'll take a thermometer outside.	A thermometer is outside all the time in a wooden box.
BK:	How do you measure how fast the wind's going?	I think you use an odometer.	It's called an anemometer.
MW:	How does the weather vane work? Does it measure?	It has a little marker thing that points to the weather and you read what it says.	It looked like an airplane without wings and it points to the direction of the wind.
KC:	How do you measure weather?	I think they attach a big balloon to a little box.	We saw a rain collecting tube and an air pollution-measuring machine. Sometimes they send up balloons. Sometimes he goes up in an airplane.

The students came back to school and made representations of the measuring tools that they had seen. Some used clay to make their models. Students shared the answers to their questions and emailed the experts to clarify any misunderstandings. One student wanted to know why snow comes down as snow and not rain. The meteorologist emailed back, "If you do not have a layer of warm air above you, the snow doesn't have a chance to melt, so it comes down as snow.

SD represented a snowboard with a flag and an anemometer.

After returning from the Water Survey field trip, HB emailed the meteorologist an additional question.

Students were very excited about visiting Fireman Eddie and the fire truck at the Fire Service Institute. Children formulated questions and made predictions of the answers. Students came back to school wanting to represent a fire truck out of boxes and junk. They worked carefully to measure the wheels, the ladder, the gauges, and the hoses. They used digital photographs to enhance their representations of all of the instruments and gauges seen on the fire truck dashboard. Their fire truck became a featured product of the culminating event.

To continue the in-depth study, students signed up for teams to investigate other neighbors around the school. The teachers arranged site visits to the Ground Water Section at the State Water Survey, the Illini Credit Union, the ceramics studio, and the University of Illinois sheep farm.

Children collected their data on field site visits. They each had a clipboard with their question, and blank paper for observational drawings. They interviewed the expert and made field notes to remind them of the answer to their question.

Back at school, students made representations of the measuring instruments that they had seen. The teachers made digital pictures available to augment their field notes and to assist their memories.

The head teacher placed the digital photos in a strategic position near the students working. She asked them to look at the picture frequently to make the representation as realistic and as accurately as possible. In one instance, students painted the money counter that they saw at the Credit Union red. Other students who had seen the photograph questioned them about their choice of color. The photograph showed the money counter a gold color and the students had painted it red. After the group discussed their discrepancy, the students went back and changed the color.

This is the digital photograph of the money counter at the Credit Union.

These boys are coloring their representation of the money counter red instead of yellow.

Students went to the Ground Water Section of the Water Survey to find answers to what people used to measure water. Students learned new vocabulary words such as coil and baler on this field trip.

The expert at the Water Survey demonstrated a coil machine to measure water in a well.

MB's representation of a coil machine.

Interviewing Experts

Parent experts included an animal researcher, a potter, a pilot, seamstress, a pet owner, and a father who brought his car to show the children what you measure in a car. Children wrote questions to ask the experts what, why and how they measure. They predicted what they thought the experts would say to answer their question. They listened to the experts, asked general and specific questions.

The animal researcher explained how she measures piglet milk consumption. She measures the pigs before and after they drink from the mother. The students questioned her about how she weighs the wiggly piglets. She told them that she measures herself first and then gets on the

scale with the piglet and weighs both of them together. She subtracts her own weight to find out how much the piglet weighs. She told the students that the piglets drink a large quantity of milk in a short amount of time.

The potter introduced the students to calipers. Students wanted to know how she measured around her pots because rulers were straight and pots are curved. She also told the students that they use non-standard measurements to tell if the pot is dry. She put one wet pot and one dry pot up to her cheeks and said that she could feel the difference. The teacher went around to all of the children so that they could feel the difference between the pots too.

A parent who was a pilot showed the sectional maps that he uses. Students also worked with maps and globes to better grasp longitude and latitude. After his visit, several students wanted to incorporate what they learned about maps into a mural for Phase 3.

The seamstress helped students design and sew individual pillows and created a class quilt. She introduced students to a quilt template, a fabric cutting board, and showed students how she measured thread and fabric. She demonstrated the use of nonstandard measurement in sewing. She held thread from her nose to the end of her outstretched arm and told students that was how she knew she had approximately one yard of material or thread.

The question, what kind of measuring does a car tell a driver prompted a parent to bring a car to the school parking lot. He demonstrated the oil stick and talked about pounds per square inch measured by an air gauge. The teacher showed the students all of the gauges on the dashboard.

One student was so engrossed with the topic of measurement that she invited a friend of her parents who was a food inspector to visit the classroom. He talked about how he inspects restaurants and checks for a healthy environment for preparing and serving food. The students asked him what he measured? He said that he checks the temperature of the freezers, refrigerators, and ovens to make sure that food is stored and cooked correctly so germs and bacteria do not grow.

As the year came to a close, students wanted to share the measurement project with parents, family and friends. They moved on to Phase 3 of the project as they designed ways to discuss and share what they learned about measurement.

Who Measures What in Our Neighborhood?

K-1 Classroom

Phase 2 Photo Gallery

Students measure objects in the room.

Students investigate the height and circumference of cylinders with the visiting university science students.

NB uses a ruler to draw a picture.

After a field visit, a student makes a representation of a "rain gatherer."

MW attempts to measure his arm span with a tape measure.

An observational drawing of the chicken incubator.

An observational drawing of a baby chick.

Who Measures What in Our Neighborhood?

K-1 Classroom

Phase 3

Sharing Results, Findings, and Understandings

Students share what they have learned with their parents at the open house.

A display of students' categorized list of what they now know about measurement.

In a multi-age classroom there is a complexity of learning exhibited. At University Primary School, teachers assessed what the children learned by examining the documentation. They looked for growth in basic skills, increased knowledge in the content areas, and a clearer understanding of the "big ideas." During Phase 3, students reviewed and reflected upon their work with the goal of communicating what they had learned. To conclude the project, students brainstormed and summarized what they had learned about *Who Measures What In The Neighborhood*? (Student Measurement Topic Web 2).

The students' reflections demonstrated that they now have a better understanding of how measurement is a part of every day life. The vocabulary that they used in their second web showed that they increased their knowledge of types of measuring tools. This vocabulary extended beyond the typical kindergarten and first grade mathematics curriculum. By using graphic organizers to analyze and draw conclusions from their data, students met and often exceeded Illinois Learning Standards for kindergarten and first grade. (See Measurement Learning Activities across the Curriculum).

Students became familiar with items in their surroundings that could be measured. Students updated parents on their measurement activities in monthly newsletters. In the February issue, students wrote about all of the things they measured in the classroom. In the May issue, students reported on their representations from their field studies. The students' and parents' reflections revealed that students became more comfortable using measuring tools for their own purposes.

A comparison of the web created at the end of the project (Student Measurement Topic Web 2) and the web (Student Measurement Topic Web 1) completed at the beginning of the project showed that some students gained the ability to distinguish between standard and nonstandard

units of measurement and students realized that measurement was essential for data collection in many fields of study. Evidence of new understandings appeared in their written reports.

To conclude the project, students discussed how they would tell the story of what they learned about *Who Measures What In Our Neighborhood?* Students worked in small and large groups sharing comments, listening, and discussing the products that they were constructing for the open house. They chose a number of ways to share their findings. Some groups finished their representations that told about their fieldwork, others worked on a fabric quilt, murals depicting the concepts learned, stories, homophones, poems, and PowerPoint presentations.

Products

Representations of Information Gained from Site Visits

Upon their return from a site visit, students met in a small group with a teacher and looked at their sketches and digital photographs. They made choices about what they wanted to represent, if they wanted to work alone or in a group, and what materials they wanted to use. The small group that went to the sheep farm worked on different representations for display at the open house. Students made a separating gate, a turning gate, a bag of wool, a spring scale, sheep and the sheep barn with a manger for 2 bales of hay, and an automatic drinking water trough. CS wrote a report about his trip to the barn.

> I went to the sheep barn. A special pen separates the babies from the mommies. A chute pours down food. There is special food that is only for the babies. A giant scale is there to weigh the grown-ups.

This is a separating gate that allows the lambs to go under to eat their special lamb food called creep.

CS and HB represent the separating gate with cardboard.

Display of the separating gate and the explanation of how it is a measuring tool for sheep farmers.

The farmers groom the sheep and give them an ear tag in a turning gate.

Students represent the turning gate with boxes and junk.

A display of a turning gate with a "boxes and junk" sheep inside ready for grooming.

At the open house students also displayed representations from the Water Survey – Ground Water Section, Ceramics Studio, Credit Union, and Water Survey Atmospheric Section. They felt these representations communicated what they had learned about the researchable questions from Phase 1 - "Who measures what in our neighborhood," as well as "What tools are used for measuring," and "What things get measured." When students explained their representations they shared how the measuring tools worked and why the people they saw used them. They felt confident that they had answered their other research questions, "How do measuring tools measure," and "Why do people measure?" At a whole group meeting, students summarized and charted their field experiences.

Who measures in our neighborhood?	What do they measure and with what tools?	Why do they measure?
Fire Service Institute	Hoses and nozzles	They need big circumference hoses for big fires.
	Ladder	They need to get the right size ladder for the height of the building.
	Water and pressure gauges	They control how much water comes out.
	Smoke detector	Measure the clean air.
	Inside fire truck cab	
	Gas gauge	Tells how much gas is in the tank.
	Speedometer	Tells how fast the truck is going.
	Odometer	How many miles it's gone.
Illini Credit Union	Coin counter	Counts how many coins.

	Coin wraps Dollar counter Cash register	Sorts coins by size and type. Counts and measures the size of dollar bills. Counts how much dollar and cents.
Ceramics Studio	Caliper Clay is weighed Potters wheel Glaze Kiln temperature & Combs	Measure around pots so the pot is the right size. Potter knows how fast and how slow to make the wheel go. Glaze is a powder that is mixed and put on the pots. Combs bend to tell that the kiln is hot enough.
Water Survey - Ground Water Section	Baler Coil Black box thermometer	Measures water in a well. Coil goes down in the well and measures how deep the water is underground. Temperature of the water underground.
Sheep farm	Separating gate Spring scale and the sling Turning gate Ear tag dispenser Lambing jug Scale Loft Stantion	Keeps the grown up sheep from eating the Creep food. Measures how heavy is the lamb. Turns the sheep so the farmer can record their health and put in a number ear tag. Measures ink. Pen for one mother and newborn lambs (usually one or two). Weighs bags of wool. Hay and grain is stored there. Bales of hay are counted, grain is ground and mixed. Holds some mother sheep by the head just right so they can't get out.

Model of a Fire Truck

Students made a model of a fire truck to communicate what they had learned from the Fire Institute. They studied their field sketches and the digital photographs, and revisited their sketches and photographs many times in the course of constructing the truck out of boxes and junk. They worked collaboratively on the model over several weeks.

A display of the fire truck made out of boxes and junk.

The completed quilt displayed at the open house.

Measurement Quilt

With the help from a parent who is a seamstress, students made a classroom quilt about measurement. They measured to cut the fabric into squares, drew a picture about measurement with fabric markers, and stitched strips of fabric to the squares using the pressure foot on the sewing machine to hold the fabric. Some students stitched the squares together in the same manner. The parent completed the quilt by sewing the backing and all of the squares together. Students found a prominent place in the classroom to display the quilt for the open house.

Murals - "What's Important about Measuring?"

After children brainstormed what they had learned about "Who measures what in our neighborhood," themes emerged. Groups of students chose to create murals. They reiterated four major concepts that became themes for the murals:

Measuring is important for making things the way you want.
Measuring is important for good health.
Measuring is important for making maps and globes.
Measuring is important for finding out what is heavy and what is light.

Students held a planning session before beginning the murals. The group illustrating, "Measuring is important for making things the way you want," discussed and recorded their ideas:

You have to measure to make buildings.
You have to measure how deep a hole is.
You have to measure paper airplanes.
You have to measure how much you weigh.
You have to measure how much money you have to buy something.
You have to measure how big something is.
You have to measure if it fits.
You have to measure how much milk you have so it doesn't spill.

Students collaborated to make a mural entitled, "What's important about measuring?"

The mural "What's important about measuring?" displayed at the open house.

PowerPoint Measurement Presentations

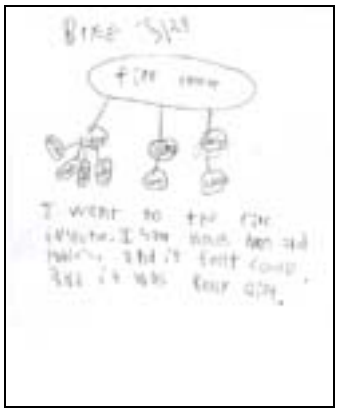
Toward the end of the project, one of the assistant teachers taught several students how to create PowerPoint presentations to communicate what they had learned. This integration of technology had two primary goals: (1) to expose the students to PowerPoint as a tool for communication, and (2) to give the students an opportunity to reflect on their own learning process through the measurement project. First, the assistant teacher gave a group of advanced readers a lesson on how to use the software. He demonstrated the features of PowerPoint on the teacher's computer and showed students how to get instructions from the "help" menu in the PowerPoint program. The students in this small group then explored creating their own presentations on other classroom computers.

The next day, the assistant teacher helped additional students prepare presentations. The teachers created a format for the presentations to include a sample of students' work from each phase of the project. Students selected a memory drawing to explain their prior experiences with measurement. Then they chose one or two of their observational drawings, or a relevant digital picture from fieldwork to demonstrate how they researched their questions. Students chose a product from Phase 3 to demonstrate their own growth in learning. While using the software, students chose the type of presentation they wanted and the slide template. Some of the students typed their answers. For other students, the assistant teacher facilitated their reflections by typing and manipulating the computer. After students chose their designs, the teacher helped them insert their digital pictures (either scanned drawings or digital photographs) into their presentation. At the open house, students took their parents to a computer that demonstrated their personal stories of how they learned about measurement (See PowerPoint Gallery).

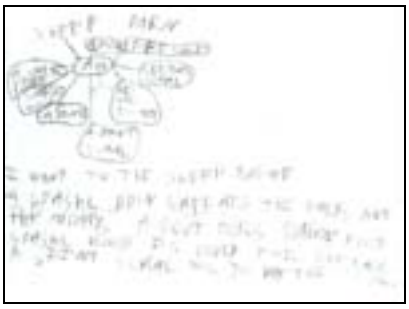
Reports, Poems, Homophones and Stories

Throughout the project there were many opportunities to write. Students wrote articles for newsletters that kept parents informed of their measurement activities. They wrote thank you letters on behalf of the class to the experts and field site guides. The teacher made non-fiction

books about measurement available in the classroom. After mapping their ideas, students wrote reports about their field site visits.



BK, first grader, mapped and wrote about his field trip to the Fire Institute.



CS made a web of his ideas before writing his report on the sheep farm.

The teachers read a number of poems to the students in whole group meetings. The teacher identified poetry elements such as metaphors and similes. Using their new measurement vocabulary, they wrote poetry and homophones during language and literacy time. They were displayed for the culminating open house.

Chicks
By AC

Chicks were resting and huddling.
They looked like a piece of yellow cotton.
Then they tried to fly.
Flapping, Flapping their wings.

Helping My Mom
By JC

I'm mixing the cake mix
A bowl
2 eggs
1 cup of water
Mix
It was fun
So now I'm helping my mom.

Soccer Goals
By MB

In soccer
You have
Six or twelve
Players

You kick
You dribble
You score Goals

In soccer
You have
Twenty minutes
Ten in each
Half

In February, students noticed that some of the messages on valentines were homophones. Students started playing with words and discovered many different homophones. Some students drew pictures, recorded their ideas and enjoyed sharing them at group meetings. The following homophones were about measurement:

Measurement Homophones

WJ	Hours – Hours in a day	Ours – Belongs to us
HB	Flour – You put in a cake	Flower – Grows in your garden
BK	Days – You know we have days and nights	Daze – Sort of crazy
JK	Foot – Ruler	Foot – That I walk on
NB	Ruler - What we measure with	Ruler – A king
TB	Cents – Money	Sense – When it sounds right, it makes sense.

The teachers read a variety of versions of *The Gingerbread Boy*. The teachers chose *The Gingerbread Boy* because it involved recipes and measuring. Children compared and contrasted the characters. They listed the similarities and displayed a comparison chart of stories written by Jan Brett for the parents.

Similarities:
- Hedgie is in three books.
- Fox is in two books.
- Woods setting in three books.
- Pig is in two books

Titles	Characters	Setting
Gingerbread Baby	Gingerbread Baby, Mom, Dad, Pig, Matti, Chicken, Cat, Dog, Goat, Sisters, Fox , Milk man	House, river, barn, gingerbread house, woods/outside, oven, bridge
The Hat	Hedgie, Cat, Dog, Horse, Pig, Lisa, Gander, Chicken	Outside in the woods, by a clothesline, house, farmhouse
Hedgie's Surprise	Henny, Hedgie, Tomten, Tomten's mother, Chicks, Goosy-goosy babys	Barberhouse/hay, field, pond, nest (Hen and Hedgie), Tomten's house
The Mitten	Owl, Mouse, Badger, Bear, Rabbit, Nickie, Hedgie, Fox, Grandma, Groundhog	Haystack/loft, woods, mitten, house.

One of the stories was entitled *Gingerbread Baby*. After reading and comparing stories, students wrote their own version of the *Gingerbread Boy* using information about measuring in the story. The temperature of the oven played a significant role in the students' stories. Teachers and peers worked with students to expand and clarify their stories. Students shared their edited versions on a book display rack at the open house.

Gingerbread Baby and Boy
By HB

A long time ago, there was a lady on a snowy day and she opened a cookbook to page 28, which is gingerbread girls and boys. She put the temperature too hot. The temperature was 100 degrees. She made a lady and a boy gingerbread cookies. They had stripes. She put them in the oven. She peeked in the oven and the gingerbread lady and boy ran away. Too bad!

She caught them with a pan, but they escaped and ran away singing, "I am the gingerbread lady with my son. As fast as we can be, we like to hide. And no one can catch us."

The son said, "Can you catch us, bet you can't, because we are free. Ha, hee, ho. Ha, hee, ho. Ha, hee, ho."

The gingerbread lady and gingerbread boy met five cats and escaped. They met two dogs and played a trick on the dogs. They met a fox and the fox gobbled up the gingerbread lady and boy. The End.

The Gingerbread Boy
By MB

Once upon a time there was a gingerbread man and woman who lived by the ocean. They had a baby whose name was the gingerbread boy. He made friends with a fox. He plays tag with the fox.

One day it was 193 degrees. The gingerbread boy lost his legs because of the heat.

Just then a big storm came and made a big wave. It washed the gingerbread boy, who got soggy and crumbled.

The gingerbread boy looked like a statue broken into pieces. That was the end of the gingerbread boy.

The End.

Music Measurement Activity

The teacher sang songs and played pieces of music with a strong rhythm. **(**See Secondary Resources). Students tapped the beat, noting 4 beats or 3 beats to the measure and the strong beat in the waltz – "ONE, two, three." Students discussed how counting the beats and the measures were some of the ways that musicians measured music. They enjoyed the homophone "measure" (related to music) and this project where they measure.

One of the teaching assistants is also an accomplished violist. He asked the students to determine the kind of measurement he does when he plays the viola. The violist played a scale on one of the strings. The children observed that the tone was getting higher and then lower. Then he asked them to look at his left hand fingers. What were they doing to the string? After a debate, the students agreed that the he made the strings longer and shorter, controlling the height of the tone. He discussed the fact that he had to learn to position his fingers on the strings in order to play in tune. If he would not make a precise measurement and position his fingers properly, he would play out of tune.

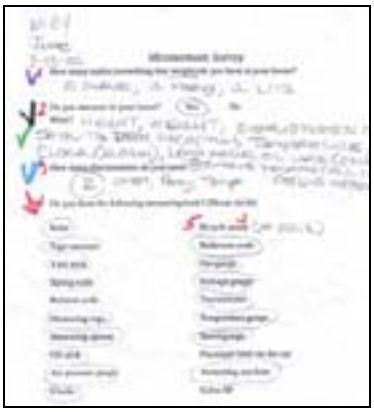
Display

Students surveyed parents about measuring devices found at home and wanted to display the results for the open house. Their questionnaire included the following:

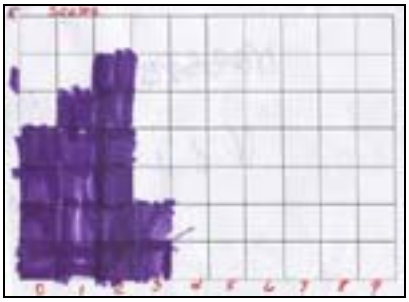
1. How many scales (something that weighs) do you have in your house?
2. Do you measure in your house? What?
3. How many thermometers do you have?

4/5. Do you have the following measuring tools? (please circle)

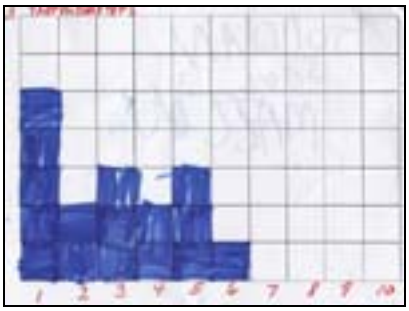
In small groups, teachers helped students analyze their questionnaire data. They prepared bar graphs to display the results for each question. One child read the parent response and marked it off on the survey. The other child transferred that data to the bar graph. This allowed readers and non-readers to work together in this multi-age classroom. Students analyzed all of the items on the questionnaire and communicated their conclusions and results.



One family's response to the questionnaire.



This graph shows that six families reported that they had two scales.



This graph shows that five families reported that they had one thermometer.

Fewer families knew about the passenger limit listed on cars.

Students concluded:

HB: The most scales that anyone has are 2. I was surprised that people didn't have 3 scales and that 4 families have no scales.

MW: It tells me that most people that we surveyed have one thermometer. The most thermometers that anyone has are 6.

TB: This graph tells me how many bicycle pumps, bathroom scales, bathroom scales, gas gauge, mileage gauge, thermometer, temperature gauge, speed gauge, passenger limit on the car, answering machines, and caller IDs there are in each house that we surveyed.

New Vocabulary Related to Measurement

Children wanted to make a list to share with their parents of all the new words that they had learned throughout the project investigation on measurement. They became skillful at integrating new vocabulary words into their conversations about measurement.

New Vocabulary Word	Definition
Air Cleaner	
Air Gauge	It shows how many units of air (PSI) are in the tire.
Altitude	When you are high, sometimes it beeps when you are losing altitude and sometimes it stops beeping to show that you're getting more.
Antifreeze	It's stuff that makes stuff not freeze. You use it to make rain not freeze to ice.
Baler	It's a thing that if you stick it in the well it fills up with water and you pull it out and you put a little thermometer in it to tell you how hot it is or how cold it is. I saw the baler at the Water Survey building. A baler is clear in the middle and you have to be careful when you take it out because there are holes on each side. You have to hold your hands on each side.
Balance Scale	
Bicyclologist	A person who helps people learn how to ride their bikes and studies bikes
Bobbin	

Bungee cord	Cord that stretches
Cage	The cage is where you put the sheep in. It has bars and a door that goes up and it is flat on the bottom and the sides. It looks like a circle on the top.
Calibrated weights	They're weights that are very heavy, even the little tiny ones. They are brown. Mr. Klein brought them in the classroom.
Caliper	It's a measuring tool that you use to make pots.
Cash drawer	It's where you put money in and you also save people's money in there in case they want some. They also have money rolls in them. I saw them at the Credit Union.
Chewing Their Cud	The sheep eat grass and then swallow it and then spit it up and chew it again. It's gross.
Chute	There is a lot of food at the top of the chute. Then the farmer turns a little knob that makes the block move out of the way and the food pours down the chute into a bucket.
Clipper	It clips the sheep's toenails.
Coil	It's a long white string and it's rolled up in a circle.
Coin counter	It's something that the people at the credit Union use. They have a bag of coins and they dump the bag into the coin counter and it counts all the money and how much they have of each coin.
Coin wrap	It's a wrap that carries coins at the Credit Union.
Cone	It helps you know the temperature of the kiln to bake clay.

Creep Food	It is a kind of food only for baby lambs to eat. It has a lot of vitamins in it.
Dollar counter	It counts the dollar bills. They are not in a bag.
Dye Tattoo	It's for sheep. They need to put a number on the sheep's back so they can tell the sheep apart because they all look the same.
Ear Tags	Sheep wear them on their ears. They wear them so their owners can keep track of them. They wear them all the time.
Flag	I saw one at the Weather Survey building by the snowboard.
Foot Pedal	
Fulcrum	
Gas Gauge	It tells you how much gas is in your car. Is it full? Is it low? A gas gauge will tell you.
Glaze	It's a kind of paint that will paint pots for you.
Global Positioning System	It shows where you are in the sky and how far you've gone, what state your in, what place.
Hay and Straw	The sheep eat hay and they lay on the straw. The hay is green and the straw is yellow.
Kiln	It's an oven that people that make pottery, they use it to cook their pots.
Lambing Jug	These are little, tiny pens where only the mom sheep and the babies go in.
Loft	It's a place where farmers store hay and water and all the other foods. It's usually at the top of the barn.

Mileage	It tells you how far you go.
Note	Dollar bills are called notes - one's, five's, ten's, twenty's - they are all called notes.
Odometer	Is a measuring tool that measures how far a machine travels. You might find one on your car or your bike. It shows how many miles your car has traveled all together since it was first driven.
Oil Stick	It's a stick that you dip in your car's oil to see how much oil is in your car. Then there are numbers on it that show you how much.
Pack bags	They're bags that hold tons and tons of things. They are very big. And they can hold about 200 pounds of stuff or more. I saw them at the sheep barn and they use them to hold the wool in.
Parkers/landers	People that help you land your airplane by waving their flags to show you where the runway is.
Peek Hole	
Potter's Wheel	
Pressure Foot	
PSI	That stands for pounds per square inch of air pressure. You use it to measure how much air is in your cars wheels.
Radar	
Rain catcher	It measures rain. It's something that catches rain and sees how much there was. And then you dump it out.
Sectional map	It's a piece of paper that shows the way to go for an airplane.

Sheering	Sheering is when you cut the wool of the sheep.
Sling	It's something that will hold a lamb up when you are trying to measure it.
Snow board	A white board with a flag sticking up. You use it to measure the snow.
Speedometers	This is a speed gauge. It tells you how fast you are going. You can find it in a car.
Spring scale	The regular scales that you have at home are spring scales.
Strobe lights	They are little things that give the plane directions for where to land and they look like little short light sabers.
Thermometers	
Thread	
Tire Valve	It's a valve that you use when you are pumping up the tire. You put the hose on it and the tire gets bigger and bigger as you pump it up with air.
Wind indicator	A thing that spins around and says how fast the wind is going.
Wool	Sheep have wool. It keeps them warm. The farmers cut it off in the spring. It is called sheering. You can make coats and things out of it. When we touched the wool, it felt oily. It has special oil in it. After you touch it, it makes your skin feel softer.

Open House

The teachers and students decided that they would hold an informal open house where parents could come any time throughout the school day. The Open House was held on the last day of school. The display in the room included products, webs from the beginning and the end of the project, a model of the fire truck, and the "Measurement" quilt. Murals and posters depicting "What's Important about Measuring" hung from the ceiling. Students reflected on their learning

and teachers placed their reflections next to their work. It is also important to note that the teachers wanted to share with the parents not only the products of the investigation, but also the process of learning. Next to the representations and beside the murals, the teachers placed a series of pictures depicting the process of the products.

Students prepared what they would say as a tour guide and they practiced their speeches by having the preschoolers come to visit the display first.

Open House Speech Dictated by the Students

Hi, I'm glad you're here.
We are studying measurement.
We want to show you some things we made and tell you some things that we learned.

We went on field trips and made these representations.
Our whole class helped make this quilt.
We all helped make this fire truck
We hatched these chicks from eggs and are studying how fast they grow.
We made pillows.

This is what I made. This is what my friend made.

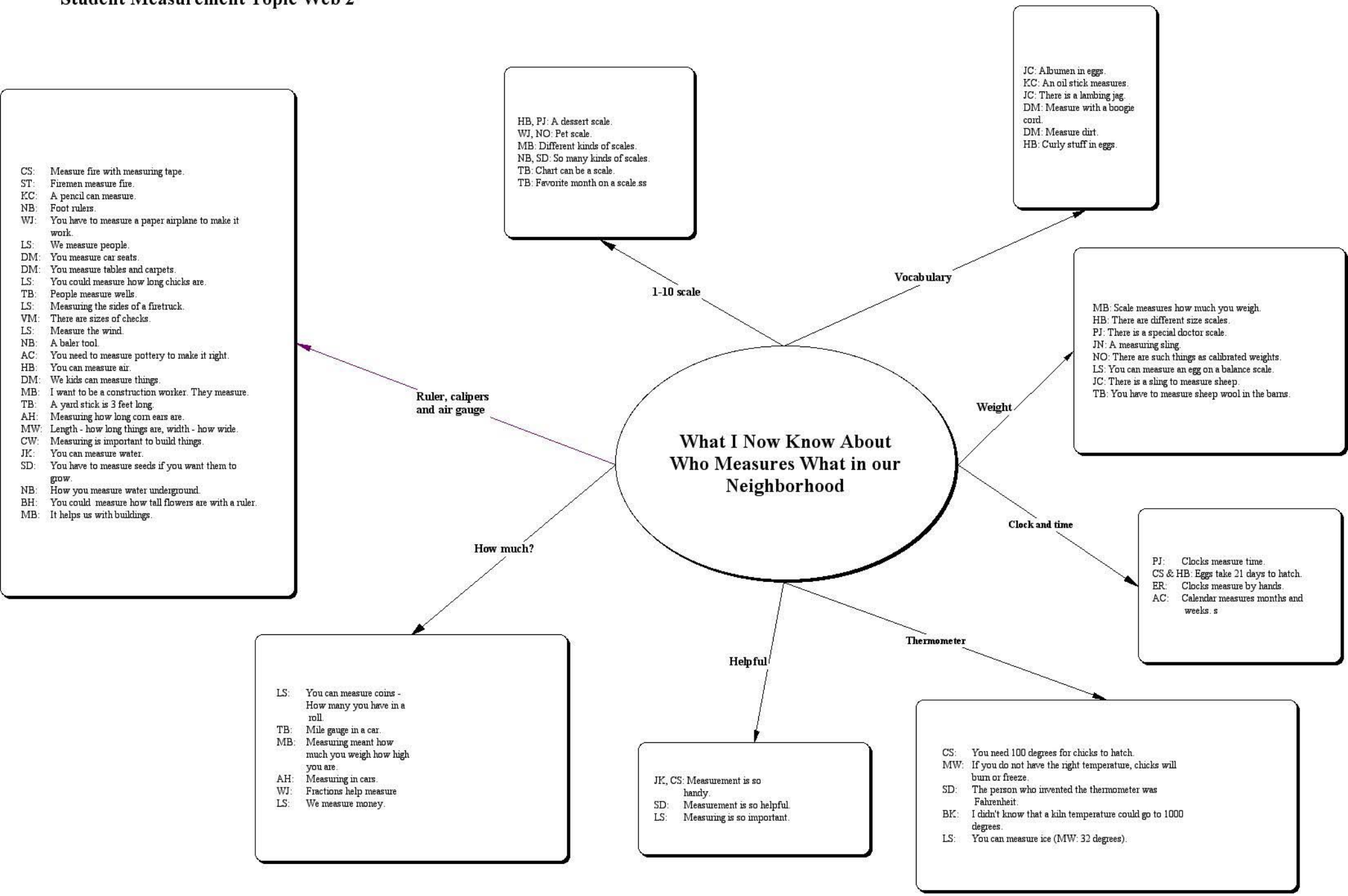
When students' parents arrived, they guided their parents through the room. They prepared a small program booklet and listed the things to do while touring the classroom.

Read the walls.
See the murals.
See the pillows.
See the quilt.
Read your child's PowerPoint presentation.
Watch the movie taken in our room.
See and read about the chicks.

The process of finding out "Who Measures What in Our Neighborhood?" is displayed on the back wall of the classroom.

Teachers gave parents a questionnaire asking them what they thought their children had learned about measurement. In the next section (Evaluation), the teachers evaluate the project. They share reflections of teachers, students, and parents and assess growth in all areas of the curriculum by examining documentation and student portfolios.

Student Measurement Topic Web 2



University Primary School
K/1 Classroom Newsletter
February Issue

Jokes
By NB
Q: Where do computers go to dance?
A: The disco

Recipes
By AC
We made Cinnamon Sugarplum cookies and we ate them. Here is the recipe:

Cinnamon Sugarplum Cookies

2/3 c. soft butter
3/4 c. sugar
1 tsp. vanilla
1 egg
4 tsp. milk
1 1/2 c. flour
1 1/2 tsp. baking powder
1/4 tsp. salt
cinnamon sugar

Cream butter, sugar, and vanilla. Add egg, beat until fluffy. Stir in milk. Sift flour, baking powder, and salt; add to creamed mixture. Drop from teaspoon onto cookie sheet. Flatten with fork and sprinkle with cinnamon sugar. Bake at 375 degrees for 10-12 minutes. Cool. This recipe makes approximately 30 cookies. Enjoy!

Measurement

BH - We are measuring windows and chairs.

JC - We took off our shoes and traced our feet and measured our feet in inches.

AB - We measured the carpet with our feet.

AH -We take a thermometer to measure how warm water is. I also measure paper. We measure for sewing, when CW's mother comes in.

VM - I made a ruler to measure things. It is made out of cardboard. I painted it blue and wrote the numbers on it.

LS - We went on field trips to measure stuff. The calendar helper gets to help measure the temperature now.

DM - We learned about measuring stuff. I love measuring water.

ST - I liked how the kids measured how big the school is.

JK - I liked when we measured cake.

PJ - We went on a field trip to see the weatherman measure the weather.

CW – JC's dad came and spoke about planes and pilots and measuring.

University Primary School
K/1 Classroom Newsletter
May Issue

The Fire Truck
By SD
The fire truck was the last to be finished for the representation. It was a big thing. A lot of people worked on it.

The Gingerbread Stories
By SD
When we made the gingerbread stories, it was fun. People liked them. Short stories would take a day.

Chicks and Eggs
By SD
We hatched chicks. A lot of children liked them. On 5/14 one chick hatched. It takes 22 days to get a fluffy chick. I know that because my sister made a chart. I don't think all the eggs would hatch.

Chicken Eggs
By JC
We are hatching eggs in the incubator. Some hatched this week. The chicks are yellow and fluffy.

The Sheep in the Gate
By JC
The sheep in the gate are turned around. They have their toenails cut and their teeth checked. Then they let them out.

The Thermometer Gauge
By TB
The thermometer gauge is like a thermometer but it is a black box. The thermometer gauge has wires. It measures water temperature.

Credit Union
By MW
Some kids - I was one - went to the Credit Union. There were different size checks. We represented a dollar counter and a money drawer.

Sheep Barn of the Day
By CS
I saw Megan weigh a sheep. Megan works at the sheep barn. There was 500 sheep. A grown up sheep weighs 200 lb.

Cash Register Drawer
By ER
We are making cash register. Here is the problem - the money slot keeps falling down. These are the girls that made the cash register: LS, AH, PJ and me.

The Water Survey
By NB
We went to the water survey. Here are the details. We saw a bayler. We saw a temperature meter. We saw a coil.

Cars
By NO
George came to talk about cars. He showed an oil stick. He also showed us how to measure the air in our tires for our car.

Mr. Klein
By WJ
Mr. Klein came into our classroom. He talked about calibrated weights. And he said it depends on what you want to measure.

Sheep Barn Visit
By KC
Some of our class went to a sheep farm. They saw sheep. There was a bag of wool. The wool was black and white.

Sheep in Sling
By HB
I saw sheep in a sling for our sheep barn visit. I made a sheep in a sling. It was made out of clay.

Gingerbread Stories
By BH
We are making gingerbread stories.

Baby Chicks
By BH
We have baby chicks in the classroom. We are drawing them. We are studying by measuring them. We get to hold them today. They felt like little fur balls.

Scrambled Eggs
By DM
We made scrambled eggs in our classroom. We ate it. It's yummy.

Eggs
By AC
We cracked eggs and looked inside.

Fire Truck
By JK
We are making a fire truck for our classroom.

Lemonade
By LS
We made Lu Lu's lemonade recipe.

Sheep Barn and Credit Union
By PJ
We are making representations of the Sheep Barn and the Credit Union.

Fire Institute
By AB
We went to the Fire Institute.

My Birthday
By VM
My birthday is on May 22nd.

Sheep Barn
By ST
We are making a representation of Sheep Barn.

Eggs and Chicks
By AH
We are measuring eggs and chicks.

Yum Soup
By CW
We made yum soup outside with mud.

Who Measures What in Our Neighborhood?

K-1 Classroom

Expanded Web

Students Elaborated from the Second Topic Web

What I Now Know About Measuring!

1 To 10 Rating Scale

HB: I saw a dessert scale in a book about scales. It was kind of a chart, and if you didn't like the dessert you said "1" and if you did like it you said "10". And there are all the numbers in between that you could say too, like 9,8,7,6,5,4,3,2. There were 2 boys and 1 girl in the book. The girl didn't like the pudding and she said "1".

WJ: A Pet scale measures how much a person likes a pet. It has numbers 1 through 10 on it. 1 means last best and 10 means the one that you really, really like. There was a mouse, a dog, kitty cat, frog, and fish in the book. The boys and girls in the book were saying if they liked or didn't like them by the pet scale.

NO: A pet scale is when you have a pet that you like the least you put it at number 1 and number 10 is your favorite animal. It's a piece of paper with 1,2,3,4,5,6,7,8,9,10 on it.

VM: I did not know there was a 1 to 10 scale. It measures how much you like things like a tornado that turns umbrellas inside out. Those tornados would be a 9 or 10. It would be a10 if it's the best tornado and a 1 if it's the worst tornado - like it would just lift a rock out of your hands.

MB: I know there are different kinds of scales. There are spring scales and balanced scales. If one weight is high and the other is low on a balance scale, the low one is heavier.

TB: You could make a scale of your favorite months by putting your favorite at the bottom and then your least favorite at the top. We read in a book that a chart can be a scale too, but I'm not sure how.

Vocabulary

JC: Albumen is the curly stuff inside an egg. You can measure it. I saw it in a book but I don't remember how they measured the albumen.

KC: An oil stick is a stick that measures how much oil you have in your car. You stick it in to where the oil is and there is an "F" for full and an "E" for empty on the stick.

JC: There is an air bubble in an egg. It gives the developing chick air.

JC: I didn't know there was a lambing jug. The mother sheep is not nice to her babies. So they put her head in a hole and what happens is that they give her food and water. Then the babies can get their milk.

HB: An egg has a yolk in the middle. Twisted threads called the chalazae keep the yolk in the middle of the egg. Chicks have different numbers of toes. First they have 3 and then they have 4. That's a type of measuring--counting!

Weight

MB: Scales measure how much something weighs. I want to be a construction worker, but if I didn't know how to measure I would never be able to be a construction worker and I wouldn't be able to measure wood with a ruler. They also measure concrete with a ruler.

HB: I know there is such a thing as a balance scale. It balances to show you weight. If one side is down, it means that side is heavier. If the scale balances both sides weigh the same. There are also doctor's scales where you can have yourself measured. On a bathroom scale, you can measure yourself.

JN: You can measure sheep with a sling. You put the baby sheep on the sling and there's a measuring thing at the top and you hold it up with the baby sheep in the sling and the spring scale at the top tells you how much the sheep weighs.

AB: There is a sling at a sheep barn. At the sheep barn they measure how much water and how much food the sheep get. They use a bucket with numbers on the side to measure the food and water. They put the baby sheep in a sling and they hold it up on a hook on a scale and the scale tells how big it weighs.

MB: I didn't know that how heavy you weigh is measuring. If you get on a scale at the doctor's office it would tell you how much you weigh. You need to know how heavy you weigh because it helps keep you healthy and lets you know if you are big enough not to be in a car seat anymore.

LS: You can measure an egg with a balance scale. It might weigh 300 pounds. You can measure a fire and a fire truck. You can measure the sides of the truck. You can measure eggs on a balance scale. You put the egg on one side and something else on the other side like a flower and see which one weighs more or less. On a scale I think the egg would be 30 pounds. You can also measure the yolk inside the egg. And you can measure a chick.

NO: I never knew there were such things as calibrated weights. They are weights that are very carefully made so that they can be exactly the weight you want them to be. You would might want to measure a chick and you might want to see what calibrated weight they are.

PJ: Special doctor scale. A scale that doctor's use to measure people, how tall they are. It's big and it has a part to tell how tall you are.

TB: The farmer measures the sheep's wool in the barns. If he didn't, he wouldn't know how much wool the sheep were producing. He has to wait for the wool to grow back. When he knows how much wool he has, the farmer knows what he can do with it--sell it or make something with it.

Ruler

CS: You can measure fire with a measuring tape. You put the ruler on your body to see how big you are and then you go in the fire with a suit on and measure it with your body. You also have to measure how much water you spray on the fire so you don't flood the house.

ST: Firemen measure fire. I never knew that firemen could measure fire. They use a tape measure. They stretch it and they are far away from the fire. They can also measure the smoke.

WJ: You always have to measure a paper airplane to make it work. To make a paper airplane, you have to get a piece of paper and measure where to fold it.

DM: Kids can measure with a ruler or tape measure. They have numbers so you can measure chicks. And you can use a scale to measure the chicks.

MB: Scale measured how much. I want to be a construction worker because if I didn't know how to measure I would never be able to be a construction worker and I wouldn't be able to measure wood with a ruler. They also measure concrete with a ruler.

TB: Yardstick is 3 feet long. They have 36 inches and they have 5 little spaces in the middle. The people at the water survey have to measure the wells so that they know there is enough water.

AH: You can use a ruler to measure corn to see how long the ears are. And you can measure with a tape measure. You can also count how many little corn pieces there are. You can also measure the plant that the corn ear was on.

MW: Length - how long, Width - how wide. I had only heard the word "width" one or two times. But now I know that "width" means how wide something is.

KW: Measuring is important - how to build things. They measure wood and metal so they can build things. You can't measure lightning bolts. You can measure a door.

HB: You can measure air. You might want to measure it to see how much air is in a tire.

AC: I didn't know that you had to measure pottery to make it just right. If you don't measure it, it might explode when you cook it. Then it would fall apart.

JK: I did not know that you could measure water. But now I know that you can measure water by using a tool that has a long string that has numbers on it and on the side there an iron. You unroll the string down into a hole in the ground and when the string can't go any more and it beeps then you have to pull it up and it tells you how deep it is.

SD: You have to measure seeds if you want them to grow, because if you didn't measure how far apart they were, one plant would take over the other.

NB: I didn't know you could measure water underground. You get a baler and you put it in a well and water comes up in it and you take a thermometer thingy and you put it in the water to see how hot or cold it is. You can measure where the water begins in the hole in the ground. You take a coil and put it in the hole and it beeps when it touches the water.

BH: You can measure how tall flowers are with a ruler. You could go outside into your garden to see how tall the plants are if you feel like it. You could also predict how tall the plants are going to be, so you can think where you want to plant them. You can measure all kinds of plants.

VM: There are different sizes of chicks. You can measure them with a ruler or any measuring device.

LS: You can measure the wind with a pipe. You take a pipe and then it catches the wind and it measures if it is really blowing hard or if it is not.

KC: I never knew a pencil can measure. You can measure how tall you are or how big a table is. You put the pencil end to end and you mark the place with your finger before you move the pencil. Your parents wouldn't like it if you marked it with the pencil!

NB: A foot ruler is a small ruler that can measure small things like a chick.

LS: I didn't know that we measure people. If you want to know if people are taller than you, then you can measure.

DM: I didn't know that you measure tables and carpets. My mommy told me you could measure them with a tape measure. You can cut the carpet to be the right size.

DM: I didn't know that you measure seats.

Clocks & Time

PJ: A clock measures time. It measures hours in the day, minutes in the hour and seconds in the minutes. I have a clock at home. It used to be in my room, but since I moved to a new house I don't know where it is.

ER: Clocks measure by hands because every hour it tells a different number. There are 12 numbers on a clock. There is one number for every hour. There's a long hand and a short hand on the clock. The long hand tells the minutes and the short hand tells the hours.

AC: Calendars measure the months and weeks. Calendars have a lot of pages and the pages have numbers on them. The numbers are for the days in the month. They have Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday on them. Time is on clocks. A clock can measure time by ticking hours and seconds and minutes.

CS: It takes 21 days for chicks to hatch. The temperature has to be 100 degrees for chicks to hatch too.

HB: It takes 21 days to have eggs hatch. I found this out from a chart at school by the chicks. In three or less days they can start eating and drinking and walking.

Thermometers

CS: The thermometer has to be 100 degrees for a chick to hatch. It can't be too hot or too cold. 100 degrees Fahrenheit.

MW: If it's not the right temperature for chicks they will burn or freeze. The right temperature is 100 degrees Fahrenheit. 99 degrees is okay too, I think. The incubator keeps the eggs at 100 degrees.

SD: The person who invented the Fahrenheit scale for a thermometer was named Fahrenheit.

BK: I didn't know that a kiln temperature could go to 1000 degrees. It needs to be that hot, so the clay can get solid.

LS: You can measure ice. You could measure how thick it is with a ruler. You wouldn't want to walk on ice if it were thin.

MW: 32 degrees Fahrenheit is the temperature that water freezes. I think water boils at 100 Centigrade. That's 212 Fahrenheit.

Helpful

JK: I didn't know measuring would come in so handy. Doctors measure people at the hospital to fix them. I measure my house and things.

SD: Measuring would be so helpful. If you didn't measure stuff, like a door, it wouldn't fit in the spot it was supposed to.

CS: I didn't know measuring came in handy. If you want to know to know how much you weigh or how tall you are, you need to measure.

How Much

LS: You can measure coins--how many you have in a roll. If you didn't know it was the right money roll you might not have the right kind of coin you needed or the right amount.

TB: The mile gauge in a car tells how many miles the car has gone.

AH: You can measure in a car. You can measure how much gas you still have or how much air is in your tire.

WJ: Fractions help measure. If you have halves and quarters you can measure half a piece of pie.

Who Measures What in Our Neighborhood?

K-1 Classroom

Phase 3 Photo Gallery

JN works on the sheep holder that he saw at the sheep barn.

A representation of a sheep holder displayed at the open house.

Clay representation of a sheep being weighed in a sling with a spring scale.

The digital picture of the bag of wool children saw at the sheep farm.

KC paints her representation of the wool bag..

AB engaged in making the sheep gate representation.

AB is painting his sheep gate.

AB contemplates how to make a sheep for his gate.

ST and HB made a representation of the sheep barn and the automatic water and feed bunk.

Next to the digital picture, KC displays her representation from the sheep farm visit.

After visiting the Ceramics studio, AC problems solves to create the peephole in her kiln representation.

AC displays her representation of the kiln.

Clay model of measuring tools used by ceramic artist.

NB problem-solved to make her baler transparent like the one she saw on her visit to the Water Survey.

After visiting the Water Survey, SD and TB make a model of a thermometer that measures the water's temperature.

Who Measures What in Our Neighborhood?

K-1 Classroom

Measure Project Video Gallery

Drawing represents children's thinking. Students are given opportunities to make observational drawings each day. The chick drawings were later compared to note how they had changed. Students noticed that the chicks looked bigger and fluffier than before.

The teacher differentiated instruction in this multi-age classroom by giving students choices that varied in complexity. Some students were using standard measurement tools and units of measures. Others were using non-standard units of measure.

This is an example of how students reflected and created a PowerPoint presentation that shared the process of learning with their parents. Students selected and explained their work from each phase of the project.

Students develop an understanding of the measurement process by exploring a variety of measuring activities with real materials from their environment such as Unifix cubes, pattern blocks, chains, tooth picks, and craft sticks. This student is using Unifix cubes to measure the length of the window sill.

Who Measures What in Our Neighborhood?

K-1 Classroom

Student PowerPoint Gallery

dmpowerpoint.ppt
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mbpowerpoint.ppt
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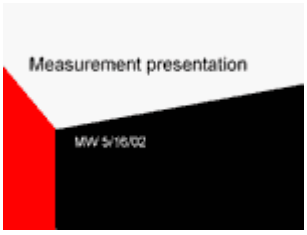

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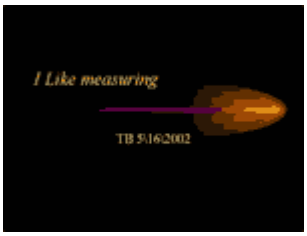

tbpowerpoint.ppt
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Who Measures What in Our Neighborhood?

K-1 Classroom

Evaluation, Reflection, and Assessment

The classroom environment enables children to demonstrate what they know through a variety of authentic assessment strategies (exhibitions, demonstrations, journals, group discussions, debriefings, interviews, and conferences). Assessment is constant and ongoing so as to identify students' strengths and learning approaches as well as their needs. Teachers observe play, watch children drawing, listen to conversations and ask questions. As children explain their thinking, teachers can assess their level of understanding. "Students points of view are windows into their reasoning. Awareness of points of view helps teachers challenge students, making school experiences both contextual and meaningful. Each student's point of view is an instructional entry point that sits at the gateway of personalized education" (Brooks & Brooks 1993, p. 60).

Documentation is vital for assessment. Documentation includes narratives of child-to-child conversations, child-to-adult conversations, photo portfolios (photo narratives), wall displays, and written summaries. Documentation offers opportunities for children to evaluate their own work, for teachers to keep parents better informed (knowledge web), and for teachers to gain a better understanding of how children learn. Documenting conversations and representations at the beginning and at the end of the project for the group as a whole and for each individual child gives perspectives of growth in all dimensions including vocabulary, concepts, knowledge, skills and dispositions.

Tomlinson's "Planning Model for Academic Diversity and Talent Development" (Tomlinson, 1996, p. 162) is a useful tool for examining how children's responses showed growth. Instead of using the model to differentiate instruction, the teachers have used it to examine how responses to the activities were differentiated among students as well as how they demonstrated growth in students throughout the study. In a project-based classroom, where many activities are open-ended, using Tomlinson's indicators can show growth. Teachers can demonstrate through child portfolios how children have gone from simple to more complex responses; concrete to more abstract understandings, and less independence to more independence in work habits and dispositions.

In an environment of inquiry, teachers look for evidence of children's growth (Klein & Toren, 1998). Children's questions may evolve from general to more specific once children have more knowledge about a topic. They may transfer their learning by making links to other things that they know and with which they are familiar. They may incorporate the new vocabulary into their every day language. Teachers look for growth in fluency of ideas and in ways in which children generate questions, solutions, hypotheses and theories. Teachers look for growth or change in students' understandings by examining artifacts of learning, which include drawings, structures, writings, and conversations. Children may also become more self-directed, more engaged, and may strengthen their dispositions to inquire, to assume responsibility, to persevere, and to take on leadership roles within a group.

The evaluation of a project investigation includes teacher reflections, student self-evaluations, parent-feedback, and an examination of each child's project portfolio to assess growth and learning. Examples of children's project portfolios are included in this document.

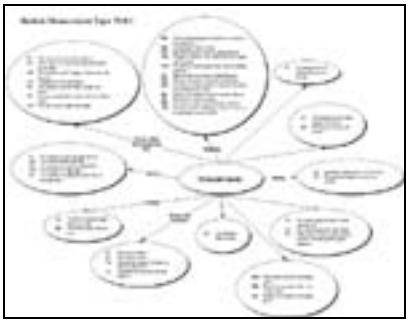
The primary method of assessing what students have learned in project investigations is through the documentation of their experiences. Teachers observed students carefully and provided opportunities for students' thinking to become tangible in order for teachers to see growth. Teachers listened and recorded students' ideas expressed in conversations, brainstorming sessions, interviews, writings, predictions, and representations. Teachers reflected upon class growth as well as individual students' depth of understanding by examining and comparing the documentation from the beginning to the end of the project. As demonstrated by the documentation, students made extensive growth in their vocabulary, in their awareness of measurement in different fields of study, in their conceptions of the importance of measurement to the world around them, and in their basic mathematical skills of measurement.

Teacher Reflections

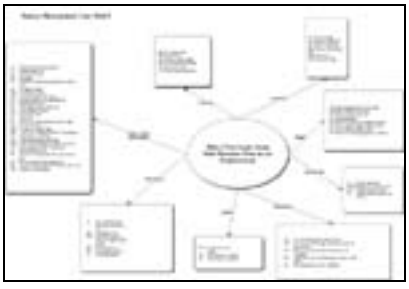
The topic of *Who Measures What in our Neighborhood?* was active and concrete with many opportunities to measure. The students studied measurement over a period of months, which allowed for in-depth inquiry and research towards understanding. The topic also allowed for complexity. Some students learned that measurement included time and money, abstract concepts that provided challenge and differentiation of instruction.

Growth in Vocabulary

In the first topic web in Phase 1, students remembered being measured or measuring at school. A few students brainstormed ideas that were not measurements that they had done, but they predicted that someone might have measured this way. The teacher categorized the students' responses on the web and found that they fell into categories of linear and weight measurement, with a few responses including liquids or solid quantities. No student recalled or used the terms area, volume, time, or money. Perhaps they did not consider these areas as being measurement. At the end of the project in the Student Measurement Topic Web 2, students categorized what they learned about measurement. They titled their categories: New Vocabulary, Ruler Work, Weight, Clocks and Time, Thermometers, How Much, and 1 to 10 Rating Scale.



Student Measurement Topic Web 1



Student Measurement Topic Web 2

Growth and Awareness of Measurement in Different Fields of Study

At the beginning of the project, when the students predicted what kinds of measuring they thought people were doing in and around the school (Phase 2 predictions), twenty-one predictions were related to prior experiences of the class. The students were surprised that the preschool students and the people in the offices outside the classroom were not engaged in the kind of measuring that they predicted. However this opened their minds to a broader view of measurement in the neighborhood.

A close look at the web (Student Measurement Topic Web 2) created at the end of the project, indicated that the students were influenced by their experiences. A comparison of the web created at the end of the project with the web from the beginning of the project showed students had increased their understanding of the measurement in different fields of study, the kinds of measuring tools that are used for collecting data, and the many things in their lives that can be measured.

To gather more information about what the students understood, the teachers asked parent volunteers to elicit more detail from the students about brainstormed web responses. Students dictated and embellished their original ideas as parents typed their responses on classroom computers. Many students named a fact from an expert, an experience, or a field visit from their work during the project. The text of these expanded responses are found in the Expanded Web. Some examples are listed below:

NB: I didn't know you could measure water underground. You get a baler and you put it in a well and water comes up in it and you take a thermometer thingy and you put it in the water to see how hot or cold it is. You can measure where the water begins in the hole in the ground. You take a coil and put it in the hole and it beeps when it touches the water.

ER: Clocks measure by hands because every hour it tells a different number. There are 12 numbers on a clock. There is one number for every hour. There's a long hand and a short hand on the clock. The long hand tells the minutes and the short hand tells the hours.

MW: If it's not the right temperature for chicks they will burn or freeze. The right temperature is 100 degrees Fahrenheit. 99 degrees is okay too, I think. The incubator keeps the eggs at 100 degrees.

AH: You can measure in a car. You can measure how much gas you still have or how much air is in your tire.

HB: I know there is such a thing as a balance scale. It balances to show you weight. If one side is down, it means that side is heavier. If the scale balances both sides weigh the same. There are also doctor's scales where you can have yourself measured. On a bathroom scale, you can measure yourself.

The teachers wanted to know if students had a definitional concept about measurement. On the last day of the project, teachers prepared a handout that asked, "What is measurement?" Student responses included volume, quantity, number, and time. The teachers noted that the students in the class had broadened their views of measurement. They referred to the practical applications of measuring that they had engaged in during the project investigation. These responses reflected that they had answered their original researchable question, "Who measures what in our neighborhood?" They also gained an operational definition of measurement through their experiences.

What is Measurement?

TB : Measurement is what you do to see how much people weigh and how tall somebody is and what time it is and the date and how wide somebody is. (7 yr)

CS: Measurement is how deep, how big, how wide, how large, how much, how much volume, and how much stuff. (7 yr)

JC: Measurement is when you measure. Measuring is a lot of things like chicks, clocks, volume, tall, short, and deep. (6 yr)

NB: Measurement is measuring all kinds of things like chicks, money, garbage, air and how long, short, how much and how heavy. (6 yr)

SD: Measurement is when you see how much something is. (6 yr)

AH: Measurement is how tall people are, how much they weigh, and how the time passes. (6 yr)

JN: Measuring is having enough, measuring is width, measuring is volume. (7 yr)

WJ: Measurement is how big, how much, how long, the depth, and a 1 to 10 scale. (7 yr)

KC: Measurement is a 1 to 10 scale, ruler, measuring tape, and a balance scale. (6 yr)

Growth in Knowledge About Measurement

Teachers noticed an increase in the number of students including the units of measure in their conversation and recording sheets. In January, when asked how tall they were, students responded with a number without a unit such as 11, 5, 4, 8, 5, or 60. In most cases the number was in error. Students measured themselves and many other items throughout the project. On 2/19, one of the students shared his measuring work at a group meeting.

MB: I measured all around the room during project activity time.

DM: I did too.
MB: I measured the plastic turtles and they were 9 and the dinosaurs were 20.
T: Were you using the ruler, or your finger?
MB: I used the ruler.
T: Were you using the inch side or the centimeter side?
MB: I don't know. I'll show you. (Gets the ruler).
T: What's the difference in reporting 9 fingers or 9 inches or 9 centimeters?
MW: 9 inches is a bigger amount than 9 centimeters.
WJ: 9 fingers would depend on the size of your finger.

By the end of the project when measuring and weighing the chicks, all students included units of measure on their recording sheets. This demonstrated that they gained a better understanding of units of measure. Students also improved their abilities to manipulate measuring tools and to measure using both standard and non-standard units.

LS records the predictions and results of measuring chicks and includes in temporary spelling ounces ("os") and inches ("n").

AC (kindergartener) uses temporary spelling to write centimeters, ounces, and inches.

Growth in Representation

Teachers saw growth in student's ability to make three-dimensional representations out of boxes and junk. Teachers guided students' work by placing the digital photographs near the student and asking them to refer to it as they proceeded to make their representations. The teacher also asked questions to facilitate problem solving:

What materials do you think would work best in making your representation?
How do you plan to show this feature?
What has worked so far?
What other materials could you use?
Look carefully, is this the color you want?

A comparison of representational structures made first semester to those made during the measurement project, showed growth in using rulers and comparing sizes and proportions to create more sophisticated three-dimensional models.

The students taped two different sized lids for wheels on the garbage truck from the fall project.

In the measurement project, the student measured the fire truck wheel to fit the truck proportionally. It attached to the truck with an axel.

Strengthened Dispositions to Cooperate and Persist at a Task

During Phase 2, students self-selected to work independently, in pairs, or in small groups to make their representations. All groups that worked together to make a common product reflected on the importance of cooperation. Most students listened to each other and shared their views about problems that needed to be solved. Teachers noticed that students became more articulate and backed up their opinions and ideas with reasons.

After returning from the Credit Union, four girls decided to work together to make a cash drawer. They drew their plans and chose to make their cash drawer from boxes and cardboard. Some problems stumped the group. They wanted to make partitions in the drawer to hold different sized bills. They had difficulty getting the cardboard to stand upright. The girls presented their problem at a large group meeting. CS offered to help them solve their problem. However, his solution did not influence their group. The next day, the girls brought their problem back to the large group. Another child offered to assist them. She cut a piece of cardboard and taped it to the cash drawer. (Interestingly, her suggestion was very similar to CS's idea.) For two days the girls diligently taped cardboard partitions in place and the cash drawer held separate bills.

This group also wanted to make dollar bills, coins and coin wraps that each of them had received as an artifact from the Credit Union. It was small detailed work and after a while, the group decided to donate their personal coin wraps to the representation to make it just right for the Open House. The next day, individuals changed their minds, and decided to keep their wraps at home. However, they still wanted to create representations of coin wraps.

AH: Teacher, LS just quit the group.
T: Why do you think she quit?

AH: She wants us to make the coin wraps this way. But we don't think it will work that way. See.
T: What can you do?
PJ: We'll just have to keep working.
ER: Maybe she'll come back when she's done with Portuguese.
AH: Maybe.
PJ: Here's my idea of how the money wraps should go. (She shows)
ER: Yeah. Lets try it that way.

After two weeks, all four were very pleased with the cash drawer, money, money wraps, a key, and a keyhole. They reflected on the process.

Money Drawer

AH: This is a money drawer.
LS: We saw it at the credit union.
ER: We had problems making the inside of it. We tried to tape it up and it didn't work.
PJ: We learned to work together. And you have to have meetings…
AH: …To talk about how you solve the problems.

Members of the group work on the partitions of the cash drawer.

LS attempts to attach the partitions to the drawer.

The girls continue to work on the cash drawer.

PJ perfects the coin wraps.

The money drawer displayed at the Open House with the digital picture below.

Conclusions

Teachers used students' misconceptions and misunderstandings in Phase 1, to develop instructional activities that supported conceptual growth. In a multi-age classroom not all students gain the same level of understanding about abstract and complex concepts. The discussion during the categorization of their memories showed some possible confusion between linear and weight measurement. The teacher decided to use this question to survey the class about what other children understood about types of measurement. On January 24th, the morning sign-in question asked, "Is measuring a baby's weight the same as measuring the inside of a clubhouse?" This time, two students who previously thought that it was the same answered no, along with the rest of the class. One child responded that the two types of measurements were the same. By the end of the project all students understood the difference between linear and weight measurement.

Some aspects of measurement continued to challenge students. On 4/16, some students asked questions at a large group meeting in an attempt to better understand the relationship between measurement and time.

HB: How does how many hours and minutes that there are in a day tell time?
BH: Hands can tell the time. But, how does it measure?
CS: Does it measure how fast the ticks go?
ER: The numbers measure.
MB: The hands tell time. What about digital?
CS: The measuring is what is happening inside the clock.
MW: What about hours?
DM: You have to get a magnifying glass to see the numbers on watches.
LS: Watches are clocks. Some of them don't have numbers.
NB: Some have lines that stand for numbers.
CS: You have to know where the numbers are so you don't need the numbers there.
DM: My watch has lines on it.
NB: You have to know that 12 is at the top and 6 is at the bottom.
AC: Some lines have a number called a Roman numeral.

BH: The five is a V.
TB: On the clocks with just lines the numbers go in order.
CS: I have something to add to NB's comment. You don't HAVE to know, but it helps.
HB: (nods) But how do the hours and minutes tell time?
T: The first people to use a clock to take the day and divide it into segments used the sun. We can make a sun clock.
AB: Yeah.

Over a series of days, students mark time by drawing the shadow of the rod.

The relationship between measurement and money also continued to challenge students. Students going to the Credit Union asked questions about the size of money and checks and how much money the bank had. ST's questions represent those of others in the group, "How do you measure money? How big or how small is it? Why do you want to know how big the money is? How much money do you have?" At the end of the project some students in the class understood the relationship between the value of money and measurement.

At the beginning of the project, students knew there were numbers involved in measurement, but they did not have enough experiences to know the relative meanings of the number. For example, 100 degrees Fahrenheit is very hot to go outside, just right for the chicks to hatch, but not hot enough to cook the Gingerbread boy. HB wrote in her Gingerbread story that the oven was very hot at 100 degrees. She did not indicate Fahrenheit or Celsius. In a conference with the teacher, she said it was Fahrenheit. Even at the end of the project, some numbers that the students wrote, although close, were still not exact.

In conclusion, this project helped students gain an awareness of measurement in different fields of study and the importance of measurement to the world around them. Students had authentic purposes to measure, collect, analyze, and evaluate data that gave them a meaningful context for learning basic skills in mathematics. Students matured in their dispositions. They improved in their ability to collaborate and cooperate and increased their curiosity about measurement. Because the project was multi-faceted, it engaged the children for five months. The comments

from student and parent reflections demonstrated that the children enjoyed the challenge of working in-depth and having the opportunities to investigate their own questions.

Student Reflections

To gain a better understanding of what students have learned about measurement, the teachers asked them to complete a questionnaire. If students could not write their own responses, parent volunteers asked them the questions verbally and typed their responses on the computer. The questions and their responses are listed below:

1. What they would tell a friend about measurement?
2. What would you like to keep doing with measurement?
3. What are you still wondering about measurement?

1. What they would tell a friend about measurement?

ST: I would tell them a lot of things about measurement. If they said, " I don't know what to measure," I would say you can measure lots of things like how tall you are, you could measure a fish or a pond or a marker, a tank, a frog, a tadpole. But you would have to be fast to catch a frog or a tadpole.
AC: Policemen measure and doctors measure people on a doctor's scale. It's a spring scale.
AH: That you can measure your mom's car, and you can measure when you cook.
ER: I would ask them if they measure. I would tell them I measure at my school.
VM: Nothing. I don't have anything to tell them about it. They probably know about rulers.
PJ: Measuring is important because you need to know things. If you don't keep the chicks at the right temperature, they will die.
JC: I would say you could measure a horse.
NO: I would say that measuring is important.
HB: Measurement helps you. If you didn't have a ruler, you couldn't measure a person. The doctor measures you to decide how much medicine to give you. I would tell him that you can measure a flower.
NB: I would say we could measure each other. We could weigh ourselves and find out how tall we are.
LS: I would tell them that measuring is important because you might not know how big you need it to be.
KC: That you can measure almost anything.
TB: There are a lot of ways to measure, like using a scale or a ruler or a yardstick.
MB: I'd say you could measure with a ruler, a tape measure, or a scale.
JN: It's important because if they didn't measure they wouldn't know how long things are.
DM: You can measure a letter like the letter A. You can use a tape measure.
MW: You can measure with a tape measure or a ruler.
AB: I would tell him about scales.

JK: My dad will measure bikes.
BK: You can measure a building, plants in a garden, and that's all I can think of so far.
WJ: That measuring tapes measure.
CS: I would tell him it is a good thing.
CW: You measure things that you build. You can measure eggs.

2. What would you like to keep doing with measurement?

ST: I don't really measure a lot. My mom does it. I only do it at school, but I want to keep measuring myself.
AC: I'd like to keep measuring how tall I am and how much I weigh.
AH: I would like to cook a lot.
ER: I'd like to measure chairs because there are a lot of parts to measure like the leg, where you sit and down the back.
VM: Nothing. I'm hooked on the computer, not measuring.
PJ: I'd like to just keep on measuring. I'd like to measure cars, computers, and TVs.
JC: I would like to measure a horse with a ruler.
NO: I don't know. I like to measure tables.
HB: I'd like to keep measuring myself.
BH: I'd like to measure all kinds of stuff like how much food I eat or what buildings I build.
NB: I'd like to measure myself to see how tall I am or how much I weigh.
LS: I'd like to keep measuring eggs, people, and other things.
KC: I'd like to measure clothes.
TB: I'd never like to stop measuring because I like measuring.
MB: I'd like to keep measuring myself. I'd like to make new amusement park rides. I'd have to measure for that so I can make them safe.
JN: I'd like to measure my baby gerbils.
DM: I would like to keep on measuring sticks, because I want to see how long they are.
MW: I'd like to know how tall people are.
AB: I'd like to measure my sister and my mom so I'd know what they weigh and how tall they are.
JK: I'd like to measure my plant.
BK: I'd like to measure buildings.
WJ: I would like to keep measuring things like my house.
CS: I would like to keep studying about it.
CW: I don't like measuring. It is too hard. I would like to keep measuring chicks.

3. What are you still wondering about measurement?

ST: I don't have any questions.
AC: I wonder how long the dragon is that hangs in our classroom.
AH: I wonder if I can measure my cat so I could see how big she is. Her name is Doodle.
ER: Do they measure in different parts of the world?
VM: Nothing. Well, maybe not nothing. I wonder how you measure a building.

PJ: How do you measure the playground?
JC: Nothing. I'm too busy thinking about going to Florida and other things.
NO: Nothing, because there's nothing else to learn about measuring except maybe when I'm in high school.
HB: How does a doctor measure with a scale? How does it work? How does the doctor know how to do it?
BH: How do they build all those rulers and stuff?
NB: I was wondering what number a yardstick went up to, but then I found I could find out easily by looking at a yardstick.
TB: How many ways are there to measure?
MB: I wonder how they measure rides. Do they measure the engine? Do they measure the tracks?
JN: I wonder how big my baby gerbils are now. When they were first born, I measured them with my finger.
DM: I wonder if it is great to measure.
AB: I'm still wondering if tape measures can have centimeters?
JK: How do you measure a little string? You can't use a ruler because string is much longer than the ruler.
WJ: How do greenhouses measure?
CS: I would still like to know how tape measurers work.
CW: I'm still not wondering about anything about measurement. I am wondering about Pokeman.

Parent Reflections

The teachers gave questionnaires to parents to determine if there was transfer of information from school to home and if students were able to generalize their newly learned concepts and apply them outside of the school context. The following are the responses from the parents:

1. Did you see evidence of your child's interest in the measurement topic? (Involvement in or excitement about the field trips, classroom, activities, products, etc?)

- Yes, KC tried to measure many more items in the house. This was especially evident with regards to cooking and measuring ingredients. She really enjoyed the field trips but she tended to enjoy all the class trips.

- Yes, LS always told us about field trips and projects and representations she worked on.

- Yes! "Hey! They're/ you're/we're measuring!" "That's measuring!"

- Yes. ST discussed the field trips a lot. She enjoyed books that related to the topic.

- Yes

- Yes
- Yes. WJ really enjoyed the project. He talked at length about many aspects.
- Yes. The sheep farm field trip was particularly interesting for AB. He also enjoyed hearing from the pilot and what he measured. The field trips were very good.
- Yes - we weighed our kittens and she uses rulers to measure things for fun. She notices a tire gauge and gas gauge.

2. Did your child talk about any aspect of the topic away from school? Did the conversations or statement reveal new knowledge about the topic?

- During this time we took a two-week road trip to California. She became very interested in the mileage and time of day. Basically how much you could drive in a day and that was related to different modes of transportation (i.e. car vs. plane vs. train).
- Yes, even in her play at home she would talk about measurement or try to measure things. She also became more aware of instruments used for measurement. In addition, she asked friends and family whether they did any kind of measurement at their work and if they wanted to come and talk about it.
- Yes, AC has new vocabulary words (measuring tools and units of measurement). She also has a greater understanding of how and why things might need measuring.
- Yes, she was especially interested in sheep and how they were measured.
- Yes. He loved learning "words" to help identify ideas.
- Yes.
- We talked about measuring and many other terms. Lots of new vocabulary, new words.
- Yes. He likes to take the tape measure and measure things and talk about how long they are. He made his own ruler at home. The topic certainly helped him learn more about the items, circumstances, and professions discussed.
- She measures how long lines are on paper.

3. Did your child like this topic?

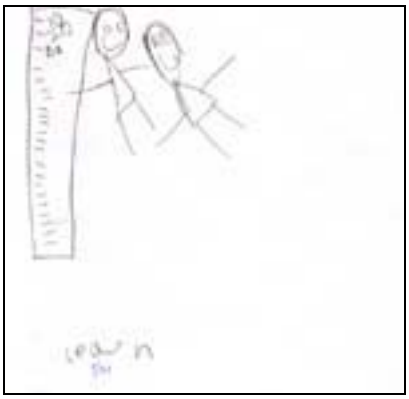
- Yes she really enjoyed the topic, but there again, she has enjoyed the other project this year.
- I believe so.
- Yes
- Yes. I think it will be a topic of discussion for a while.
- Yes.
- Yes.
- Yes. WJ enjoyed the project. I am sure he will continue to ask questions in the future.
- I think talking about measuring was a good way to introduce children to lots of different experiences, professions, and systems, while at the same time, bringing them together under the theme.
- Yes, being interactive she found it fun.

Individual Student Growth - Student Portfolios

Teachers maintain portfolios of students' work samples throughout the year. To evaluate individual growth in a project, the teachers and students reflect and examine the documentation in the students' project portfolios. Five examples of students and their areas of growth are included below.

LS's (6 yr) and Growth in Observational Drawings - From Simple to Complex

Drawing represents children's thinking. As students progress from simple to complex drawings, they are demonstrating that they understand more about the topic. Teachers saw evidence of growth and change of understanding over time in LS's observational drawings.



In January, LS places a few random numbers on the ruler in her drawing.

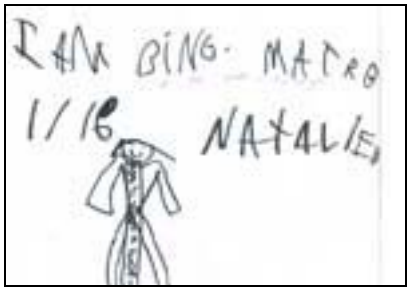
LS's memory drawing shows a large ruler with a few numerals on it.

In May, LS draws a more accurate representation of a ruler at the end of the project.

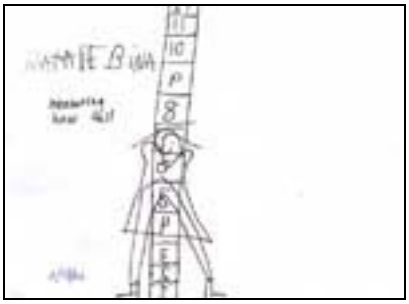
Not only did LS become more aware of measurement tools, she even asked a friend of her family if he could come and talk about the kind of measuring he did as a food inspector. LS arranged for the food inspector to come and talk to the other students at school.

NB's (6yr) Growth in Representing and Understanding - Smaller Leap to a Greater Leap

In April, NB predicted that she was 8 inches tall before being measured. Early in the project she drew and labeled her picture, "I am being measured." A month later she drew the ruler taller than her body. However, in each drawing, the ruler indicated that she was 8.



On 1/16, NB draws the ruler stopping at 8. However, it was too short to measure the person.



2/13, NB draws the ruler going taller than the person.

After a parent measured her at school, she proudly announced that she was 47 inches tall. At the end of the project in May, NB wrote about foot rulers for measuring small things like a chick. She also talked about yard rulers for measuring taller things. She commented that she would need "two yard rulers," not foot rulers, to measure her. The student reflections demonstrated that she gained a real interest in measuring and felt empowered to measure herself and others. Notice how all three responses in the student reflections related to her identity as a child who sees herself as being competent to measure.

What would you tell a friend about measurement?

NB: I would say we could measure each other. We could weigh ourselves and find out how tall we are.

What would you like to keep doing with measurement?

NB: I'd like to measure myself to see how tall I am or how much I weigh.

What are you still wondering about measurement?

NB: I was wondering what number a yardstick went up to, but then I found I could find out easily by looking at a yardstick."

Using Digital Photographs for Assessment and Teaching

The digital photographs became both a tool to extend learning for the students and a way to enhance evaluation and assessment for the teachers. The teachers gave students the photographs from their field experiences to help them represent what they saw and learned on their trips. Using the digital photographs, students carefully tried to match their representations to the pictures. The digital camera was a new purchase this year. The teachers suspected that not only did students mature in their ability to represent their ideas over the year, but that the digital photographs greatly improved their attention to details and their ability to make more realistic and accurate representations in the measurement project.

BH's (5yr) Growth in Representing - Simple to Complex

BH was self motivated and worked independently on his three-dimensional representations. Over the months he demonstrated his increased attention to detail as he covered the boxes with paper and paint to transform them to model the objects that he was representing.

Digital Documentation of Process	Teacher's Comment
	In September, during the fall project on *Keeping our Environment Healthy*, BH chose to make a simple three-dimensional construction out of cardboard.
	In October, BH had big plans for his three-dimensional work and would return to it over several project/activity time periods.
	He made a series of boats with construction paper taped to cover the words of the box. He was proud that his boats did not dump garbage into the water, but rather reduced, recycled, and reused.

	Throughout November, he continued to paint his series of boats to make them look complete.
	By December, BH's three-dimensional construction of a ship has many details and a coat of paint to give it a more finished appearance. He returned to his project over several days and worked diligently until completion.
	2/29/02 BH used clay at the beginning of the measurement project. He misnamed the ruler a scale.
	In the measurement project BH worked collaboratively with two other children on making a money counter. Working as a team was a new experience for BH. Even though it appeared that he knew that the money counter was not red, he didn't object and helped paint it. Afterward he reported, "We needed to repaint it, because the color we used in the beginning wasn't good."

	BH embellished his ideas on the second topic web by explaining how he could measure or predict the height of flowers. BH: You can measure how tall flowers are with a ruler. You could go outside into your garden to see how tall the plants are if you feel like it. You could also predict how tall the plants are going to be, so you can think where you want to plant them. You can measure all kinds of plants. The statement infers that he conceptually understands how to measure with a ruler. However, because he placed the numerals on the ruler with 1 on the top, he may have misconceptions about how to use the tool for measuring, or he may not have paid attention when he was making his drawing.

The documentation often provides evidence that students have shown discrepancies in their understanding. Teachers need to plan additional activities to teach and further assess students' knowledge. In this case, BH performed other measuring activities satisfactorily in class.

MB's (6 yr) Growth in Representing, Greater Engagement and Persistence

The teachers watched the ways that students chose to represent their ideas. Teachers probed students' thinking by asking questions. MB grew in his disposition to attend to details and to independently stay engaged for longer periods of time.

Digital Documentation of Process	Teacher's comment
	In September, MB's representation of the garbage truck during the fall project is simply made. There are few details and no attempt to make it look finished.

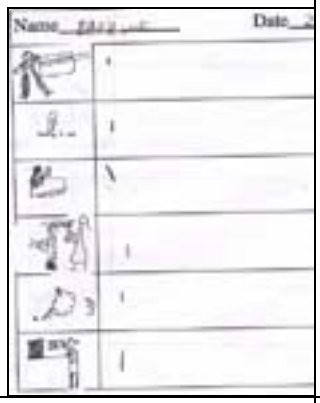
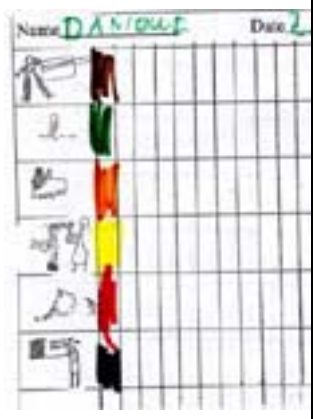
	In late April, MB and JK worked as a team to find the right material to make a coil representation. They discussed and tried out materials in answer to the teacher's question, "What materials do you think would work best in making your representation?" They tried clay and were unhappy with the results. The photograph shows that in the first week of May, they are working with paper shreds.
	As MB contemplates how to make the thin pieces of paper roll like a coil, JK puts the shreds on his head. MB is frustrated by the thin pieces of paper tearing and JK not contributing. MB & JK decide to work on separate representations.
	Looking at the digital photograph, MB thinks about his options.
	5/13 MB tries cardboard cylinders in answer to the teacher's question, "What other materials could you use?"

	5/16 MB solicits help in holding and taping the tubes to make the coil representation. MB worked diligently on getting the coil to look the way he wanted.
	5/23 The coil had many numbers on it. MB's idea was to write numbers around the coil with a pen. He found this to be tedious work so he decided to write on a third of the coil each day.
	5/30 This is the Open House display of MB's coil representation next to the digital picture.

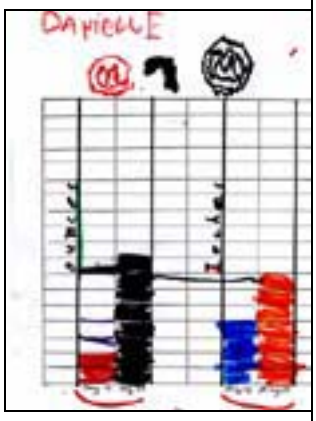
DM's (6 yrs) Growth in Thinking and Reflecting on Her Past Experiences and Data Collecting - Simple to Complex

DM had experience with project work in her previous class. Her academic skills were on par with typical kindergartners, but she was less accomplished in social skills and expressive vocabulary. DM was able to formulate questions but self-evaluating and reflecting on her own work was difficult for her.

Date	Child's Comment	Context for Documentation	Teacher's Comment
1/7	First comment: You have to measure wells – you know, water. Second comment: You measure basketball hoops.	This is a whole group brainstorming session.	At this meeting, children reflected on what they knew about measurement. Many of the students brainstormed about experiences that they had. DM had difficulty reflecting on her past. After a child remembered about measuring the depth of swimming pools, DM offered measuring wells. Again, a child brainstormed, "You measure to have the right size bat." DM suggested. "You measure basketball hoops." DM didn't appear to recall her own experiences, however when she listened to peers' comments she offered something similar.
1/16		Memory drawing saying: "My Auntie measured me for a dress."	DM drew a long measuring tape with no numbers on it.
1/24	Answered a sign-in question under "yes" that measuring a baby's weight is the same as measuring the inside of a clubhouse.	After the students grouped their memory drawings by similarities, she responded to the sign-in question.	In the discussion on 1/22, DM talked about an experience that she now remembered - that her baby brother got weighed but she did not differentiate in the discussion or on the sign-in question between types of measurement (linear or weight).
1/28	DM: You can measure the lake. This is a ruler measuring into a swimming pool.	DM joined the group discussing difficulties that they had in measuring liquids.	DM joined a group of friends. She had brainstormed about measuring water. However, she had not measured wells in the past. She had experiences with liquids in pouring drinks, but she did not mention it.
2/15	DM: I think we'll see people measuring wells for water.	Students predicted all the ways they thought people measured in and around the school building.	All the predictions except DM's were based on previous experiences. DM did not make a prediction that was linked to her past experiences in the school.

2/19	One tally mark in each category. 	Data collecting on a field site visit to the offices in our school building during math time.	DM did not appear to understand data gathering or connect marking a tally behind a picture after seeing a measuring device or someone measuring. When the teacher had a conference with her, she said she had seen all those things one time. This did not agree with the data collected by the rest of class.
2/21		Data collected is translated to a bar graph during math time.	DM translated the data to the bar graph correctly.
3/8	DM: We learned about measuring stuff. I love measuring water.	DM's entry for the K/1 classroom newsletter, <u>February issue</u>.	Since beginning the project, DM has commented about water. This entry in the February newsletter is a realistic reflection on her experiences.
3/11		During journal writing time, DM draws and questions, "Why do you measure with the ruler?"	DM sincerely wondered why people measured with rulers. This drawing is the first piece of evidence that she was beginning to reflect on what she wanted to know.

3/14	DM works with AC on painting a box white.	The work is to represent the kiln that she saw with a small group on a field visit to the Ceramics studio on 3/13. She painted the box during project/activity time.	Three girls decided to work together to make a kiln representation. They planned what materials they needed. DM contributed by painting for a short while.
3/15	DM scribbled in round black circles over the white paint.	During project/activity time, a digital photo was placed so DM could see the black straight lines that looked like bricks.	The other two girls, NO and AC, decided that DM was tired of working on that representation and that was the reason she was not being careful. They were upset at their work having to be redone. The thin straight lines may have been a manual dexterity challenge for DM.
4/2		DM chooses to measure around the room during project choice time.	DM made a choice of something that interested her and worked collaboratively with someone else on a common task.
4/17		DM painted on one side of the fire truck during project/activity time.	DM positively contributed to a shared group representation. She was successful partly because she was alone on that side with her own brush and it was not delicate work.
5/14	DM: I didn't know that kids can measure with a ruler or tape measure; I didn't know that you measure tables and carpets; I didn't know that you can measure seats.	End of the project brainstorming session during a whole group meeting where students shared what they learned about measurement.	DM comments are directly related to some of her chosen classroom experiences that involved linear measurement. The average age of conservation for number and linear measurement is 6 – 8 years. She had a clear understanding between linear and weight measurement.

5/21		Illustration of what she now knows about measurement.	The drawing showed that DM had put numbers on the ruler realizing how important numbers are in measuring. In her memory drawing in January, she did not draw numbers.
5/24	DM: People measure other people with a tape measure to see how tall they are. They can measure bricks with a tape measure to find out how big they are and you could use them for buildings. Measuring is important for making a map of the world because you have to measure how big is the world.	Students generated four themes of "What's Important about Measuring." They worked in groups planning and making murals to be displayed at the Open House.	DM chose to work with the group on the mural, "Measuring is Important for Good Health." She was uncooperative with the group and the group asked her not to work with them. DM decided to work alone on a poster. She dictated what she was illustrating. She talked about three of the four themes all in one.
5/28	DM PowerPoint presentation.	DM chose to make a PowerPoint presentation.	The PowerPoint presentation shows an increased ability to reflect on her experiences.
5/30	DM took data from measuring and weighing chicks. 	The data was placed on a graph.	DM grew in her ability to gather data. She was able to gather data, graphically organize it, and communicate the findings.

Although DM made positive contributions on shared group tasks at times during the project, improving her social skills remained a target goal. DM showed gains in her ability to think about measurement and reflect upon her past experiences. She also grew in her ability to gather data and organize it meaningfully.

Who Measures What in Our Neighborhood?

K-1 Classroom

Measurement Calendar
Step-by-Step Lessons

Phase 1

1 **Opening Event** At a whole group meeting, the students shared a number of measurement events that they remembered from the fall project.	2 **Brainstorm Ideas** Students brainstormed ideas about measurement from their own experiences.	3 **Categorize Ideas** The students discussed how to categorize their ideas and experiences.	4 **Label Categories** Students debated how to title the categories for Measurement Topic Web 1.	5 **Share Personal Stories** The head teacher shared stories and pictures of the special wall in her kitchen where family members recorded their heights. She asked students to share personal stories about measurement.
6 **Illustrate Stories** Many students drew and wrote about times when they were measured or times when they helped someone measure.	7 **Share Stories** The students shared their experience stories and grouped them by similarities.	8 **Collect Data** Students developed questionnaires and asked their peers questions such as, "Have you been weighed at the doctor's?"	9 **Represent Findings** The students represented their findings using a pie chart.	10 **Articulate Questions** The teachers and students wondered about measurement. Students wrote or dictated questions that they would like to investigate about measurement.

Phase 2

11 **Group Planning**	12 **Make Predictions**	13 **Engage in Field Work***	14 **Debrief**	15 **Create Representations**
The students measured items found in the classroom. They decided they needed to visit people in and around the school building to see how and what they measured.	Before each site visit, students wrote questions for the experts and predicted the responses. They also made a list of things they thought they would see.	Students collected data to answer their measurement questions. Teachers planned field trips to the Water Survey, Illini Credit Union, ceramics studio, Fire Service Institute, Children's Research Center, and sheep farm. Students interviewed experts, collected artifacts, counted, made observational field sketches, and took pictures with a digital and video camera. *This may take weeks!	Students shared experiences and compared their findings with their predictions.	Students represented their findings with constructions, clay models, paintings, and graphic organizers.

16 **Share**	17 **Plans for Visiting Expert**	18 **Expert Visitor**	19 **Debrief**	20 **Continue Investigation**
The students shared their progress on their representations at whole group meetings. Classmates offered suggestions for refinement.	Students formulated questions about measurement and predicted what the visiting expert might say to answer their questions.	Students interviewed a mechanical engineer, a food inspector, an animal researcher, a potter, a pilot, a seamstress, and a car owner.	Students compared experts' answers to their predictions. They made observational drawings of the artifacts loaned by the experts. Examples include an antique spring scale, pilot calculating equipment and sectional maps.	Students did experiments related to measurement. For example, they weighed collected items and placed them from lightest to heaviest.

Phase 3

21 **Representations**	22 **Articulate What Children Have Learned**	23 **Brainstorm Second Topic Web**	24 **Label and Categorize Ideas**	25 **Plan for Sharing**
Students made many 3-dimensional representations of measurement tools including a coin counter, baler, coil, kiln, and sheep gate.	The whole group discussed what they learned about measurement.	Students listed their ideas of "What they now know" about measurement.	Students formed categories of similar findings, understandings, and ideas. Students completed their Measurement Topic Web 2.	The teachers and students planned the culminating event together. Students decided to make "What's Important about Measurement" murals and display their representations. The teachers planned for students to reflect upon their investigations and create PowerPoint presentations.

26 **Project Highlights** Students prepared to share aspects of the project investigation by using murals, reports, Power Point Presentations, and displays in a museum format.	27 **Imaginative Activity** Students wrote variations on the *Gingerbread Boy* story emphasizing measurement. They integrated new understandings about measurement in their homophones and poems.	28 **Display** Students contributed to the class display. Teachers showed work from all phases to show growth in knowledge and understanding.	29 **Culmination** Parents toured the displays and heard their children share what they had learned about measurement.	30 **Evaluation** Students and parents reflected on the project by responding to a questionnaire. Teachers examined students' project portfolios to assess growth and learning.

Who Measures What in Our Neighborhood?

K-1 Classroom

Measurement Resources

Primary Resources

Experts

- Musician
- Parent who spoke about cars
- Pilot
- Potter
- Scientist
- Seamstress
- State of Illinois food inspector
- Undergraduate science students
- Veterinarian researcher

Hands on materials

- Balance scale
- Boxes and junk
- Brooder box and heat lamp
- Calendars
- Cardboard
- Clay
- Clocks
- Computers
- Fabric
- Incubator
- Legos
- Measuring cups
- Measuring spoons
- Money
- Needles and thread
- Paint
- Paper (large and small)
- Rods
- Ruler
- Sewing machine
- Spring scale
- Thermometer
- Trundle wheel
- Unifix cubs

Field site visits

- Atmospheric Environment Section of the State Water Survey
- Car parked in parking lot
- Children's Research Center
- Ground Water Section of the State Water Survey
- Illini Credit Union
- Illinois Sheep Farm
- Fire Service Institute

Software

- Inspiration
- Kid Pix
- Kidspiration
- PowerPoint

Secondary Resources

Books and Stories

Adler, David A, (1999). *How tall, how short, how faraway.* New York: Holiday House.

Axelrod, A. (1997). *Pigs will be pigs.* Glenview IL: Scott Foresman.

Bell, J., & Bell, M. (1988). *Everyday mathematics.* Chicago: Everyday Learning Corporation.

Berenstain S., & Berenstain J. (1973). *The Berenstain bears' nursery tales.* New York: Random House.

Beskow, E. (1974). Pelle's new clothes. In S. Corrin, & S. Corrin (Eds.) *Stories for under-fives* (pp. 105-107). New York: Puffin Books.

Branley, Franklyn, (1976). *How little and how much.* New York: Thomas Y. Crowell Company.

Brett, Jan, (1999). *Gingerbread baby*. New York: Scholastic Inc.

Burton, J. (1988). *Chester the chick.* New York: Random House.

Carle, Eric, (1995). *Walter the baker*. New York: Scholastic Inc.

Cole, J., & Calmenson, S. (1994). *Why did the chicken cross the road? And other riddles old and new.* New York: Scholastic.

Cosby, B. (1999). *The day I was rich.* New York: Scholastic.

Davidson, A. (1990). *How big is big: Math rhymes to read together.* Bothell, WA: The Wright group.

DeRubertis, Barbara, (2000). *LULU's Lemonade*. New York: The Kane Press.

Dussling, Jennifer, (2000). *The 100 - pound problem*. New York: The Kane Press.

Flournoy, V. (1985). *The patchwork quilt.* New York: Penguin Books.

Friedman, A. (1994). *A cloak for the dreamer.* New York: Scholastic.

Froman R. (1971). *Bigger and smaller.* New York: Crowell Company.

Frost, M. (1990). *In the chicken coop.* Bothwell, MA: The Wright Group.

Garelic, M. (1968). *What's inside.* New York: Scholastic.

Gwynne, F. (1970). *The king who rained.* New York: Simon and Schuster.

Heine, H. (1983). *The most wonderful egg in the world.* New York : Atheneum

Heller, R. (1981). *Chickens aren't the only ones.* New York: Putnam.

Holtzman, C. (1995). *A quarter from the tooth fairy.* New York: Scholastic.

Hooper, M. (1985). *Seven Eggs.* New York: Harper Collins.

Hutchins, P. (1968). *Rosie's walk.* New York: Scholastic.

Kwitz, M., D. (1981). *Little chick's big day.* New York: Harper & Row.

Leedy, Loreen, (1997). *Measuring penny*. New York: Henry Holt and Company.

Lesser, C. (1995). *What a wonderful day to be a cow.* New York: Random House.

Little red hen. (1985). New York: Scholastic.

Miniarik, E., H. (1957). *Little Bear.* New York: Scholastic Inc.

Murphy, Stuart, (1999). *Room for Ripley*. New York: Harper Collins Publishers.

Murphy, Stuart, (1999). *Supersand castle Saturday.* New York: Harper Collins Publishers.

Older, J. (2000). *Telling time.* Watertown, MA: Charlesbridge Publishing.

Pluckrose, H. A. (1995). *Math counts: Length*. USA: Children's Press Edition.

Polacco, P. (1988). *The keeping quilt.* New York: Simon and Schuster Inc.

Polacco, P. (1988). *Rechenka's eggs.* New York: Putnam.

Richards, K. (2000). *It's about time, Max!* New York: The Kane Press.

Ross, D. (1979). The little small wee tiny man. In S. Corrin, & S. Corrin (Eds.) *Stories for under-fives* (pp. 67-72). New York: Puffin Books.

Schneider H. & Schneider N. (1946). *How big is big.* New York: Scholastic Inc.

Schwartz, D. (1989). *If you made a million.* New York: Lothrop Lee & Shepard.

Selsam, M. (1970). *Egg to chick.* New York: Harper Collins.

Sendak, M. (1962). *Chicken soup with rice: A book of months.* New York: Scholastic.

Srivastava, J. J. (1970). *A young math book: Weighing and balancing.* Toronto, Canada: Fitzhenry and Whiteside Limited.

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Who Measures What in Our Neighborhood?
K-1 Classroom

Measurement Learning Activities Across the Curriculum Relationship to Illinois Learning Standards

Arts and Aesthetics

*constructing (LS26A1e)

- build 3-dimensional objects (e.g., kiln, sheep barn, cash drawer, baler, etc.) with craft supplies, wire, pipe cleaner, modeling clay, cardboard, boxes and junk, food, and commercial made materials such as the following:
    - Legos
    - pattern blocks
    - Cuisinaire rods
    - place value blocks
    - wooden blocks
- measure costumes made for dramatic play
- problem solve
- representation of the measuring devices used in neighborhood
- *What's Important About Measuring* murals

*dramatizing (LS25A1b and LS26A1b)

- dramatize the nursery rhyme the *Derby Ram* and *Hot Cross Buns* after discussing the measurement that was involved in the rhyme
- practice play lines for story innovation of books, *Chicken Soup with Rice* and *The Gingerbread Boy, etc.*
- role-play firemen
- use costumes measured and created to explore creative dramatics

*memory drawing (LS26B1d)

- draw measuring and measurement tools
- draw predition of what they will see on walk around preschool classroom and neighboring offices
- draw pictures of what their question is about to help them remember their project questions (e.g., questions for on-site experts, etc.)
- draw predictions of what expert will say about measurement
- use rulers to draw pictures

*observational drawing

- draw measurement tools (balance scales, measuring spoons, measuring cups, spring scale, thermometer, clock, watch, sectional maps, rulers, tape measure, calibrated weight, incubator) (Time 1 drawings)

- draw measurement field trip sites (Time 1 drawings)
- draw people measuring (children, sheep, wool, feed, oil in car, snow, rain, wind, chicks, wells, kiln temperature, fire hoses, fire ladders, fire gauges,, and counting money)
- revisit observational drawings and elaborate, edit, and revise to make Time 2 observational drawings of measurement tools, and measurement field trip sites

*painting (LS26A1e)

- paint measurement pictures
- paint fire truck, kiln, sheep barn, money counter, cash drawer, coil, water thermometer, sheep fence, sheep gate, and bag of wool made with boxes & junk
- paint mural for culminating display
- revisit observational drawings to add detail or information and color with water colors

*relating art to literature

- draw pictures and write responses to *Gingerbread Boy, A Little Pigeon Toad,* and *Why Did the Chicken Cross the Road? etc.*

*representations (LS26A1e)

- create measurement pictures on the computer with Kid-Pix
- create "measurement" mural
- draw pictures to imitate artistic style of visual artist whose paintings relate to measurement
- make two-dimensional drawings of kiln, pottery, weather instruments, fire trucks, money, clocks, thermometers, sheep, sheep barn, car gauges and a variety of pictures that they drew throughout the investigation
- represent top view, side view, back view and inside view of scales

*responding to music (LS25A1c, LS26A1c, and LS26B1c)

- listen for fast/slow, high/low, soft/loud and musical patterns
- listen to sounds at measurement field site and reproduce sounds with instruments
- move creating a simple creative dance and draw after listening to classical music
- write a poem with words to describe sounds of measurement tools (e.g., clocks ticking)

*singing, movement and dance (LS25A1a and LS26A1a)

- Create a simple dance
- sing *Chicken Soup with Rice, Miss Mary Mack, Over in the Meadow, There's a Hole in the Bucket*
- tap and clap to the beat

*viewing visual art exemplars (LS25A1d)

- discuss art prints that feature measurement and analyze elements of art - line, shape, color and texture

Language and Literacy

*analyzing (LS5B1a)

- analyze information gathered through field studies (field notes, data tabulation, video of expert interviews, photographs, etc.)

*classifying

- classify memory drawings
- classify questions that children asked to pursue study groups
- sort and classify ideas for Student Measurement Topic Web 1 and Student Measurement Topic Web 2.

*comparing

- compare and articulate differences in definitions
    - weight, height, width
    - 1 - 10 scale, spring scale, balance scale
    - Farenheit and Celcius
    - oil gauge, gas gauge, battery gauge, heat gauge, air gauge
    - speedometer, odometer, thermometer, barameter, anemometer
    - foot, feet, yard, meter, centimeter, inch, pounds per square inch
    - egg, shell, membrane, albuman, yolk, embryo
    - chick, chicken, hen, rooster
    - clock, watch, sun - dial, digital, analog, day light savings time
    - diameter, circumference, area
- compare different kinds of chicks
- compare different kinds of rulers
- compare different kinds of scales

*critical thinking (LS5A1a)

- decide on what to present for culminating event
- decide what to include in mural for culminating event
- predict, hypothesize, or theorize the answers to their questions
- support own opinions when responding to questions such as the following:
    - Why do people measure?
    - What is measurement?
    - What is important about measurement?
    - Why is it important to measure?

*developing oral language (LS4A1a and LS4B1b)

- brainstorm what they remember about measurement
- categorize and label to form a topic web or graph
- design survey questions and ways to show results of surveys - example - Do you measure in your house? What?
- discuss in group meetings (whole class, small group, or one-to-one)
    - measurement project "opening event"

    - question of the day
    - responses to different versions of *The Gingerbread Boy*, tunes for *Miss Mary Mack*, and *Chicken Soup with Rice*, and art exemplars
- interview experts
- listen in large group discussions, small group, one to one, and to experts
- report progress on representations, experiments, research, etc.

*formulating questions (LS4A1b and LS5A1a)
- develop researchable questions
- ponder questions at the end of the project

*integrating new vocabulary
- brainstorm words they know about the topic before and after studying (Topic Web 1 and Topic Web 2)
- use new vocabulary words in conversation

*making lists
- jobs related to measuring
- kinds of measurement tools in our school
- make lists of what they might see
- make lists of what they would like to research
- questions, predictions, and findings
- questions to be asked on parent questionnaire
- vocabulary
- what kinds of things are measured
- what they had learned who to thank
- what they might do
- what they would need for their representations, models, etc.
- who to thank

*planning
- draw a design for representation
- develop power point presentation
- follow phases of writing, pre-write and discuss ideas for "Gingerbread Boy innovation" stories
- write web for chick and egg knowledge
- write web for measurement report

*presenting (LS4B1a)
- explain measurement posters, models, experiments, representations and stories to the neighboring classroom and parents at the culminating event
- share personal measurement story with the class
- share progress on representations with the class
- share stories, and poems written about measurement with the class

*reading (LS5A1b)

- choose measurement, chicken, or joke books for Independent Reading time
- dictate a project experience story (after a field trip, after talking with an expert)
- make a book out of experience story
- read about fire safety from an Internet search
- read child authored stories
    - adapted stories
    - "Gingerbread Boy" innovation
    - poems
    - jokes and homophones

- read nursery rhymes booklets - *Are you Sleeping, Wee Willie Winkie,* etc.
- use experience story for reading

*reflecting

- brainstorm "What I Now Know"
- edit stories for publication
- respond to the literature through writing or discussion
- self - evaluate
    - what I have learned about the project
    - progress to complete any part of the project
    - PowerPoint presentation
- think about and write or tell "what I learned" after field visits

*using references and resources (LS5A1b)

*writing (LS5C1a)

- book log entries of the title, author, date and comments about books read
- describe the sound of newly hatched chicks
- label parts of an egg
- plan representations and presentations for culminating event
- record field trip and expert findings
- write measurement questions
- write invitations for culminating event
- write memory stories about measurement
- write number stories about the project
- write or dictate a self-evaluation of measurement project
- write stories that integrate new knowledge about measurement
- write poetry that integrates measurement
- write power point presentation
- write predictions of what they will find out on field trip or from experts
- write reports on what they have learned
- write stories about various aspects of the topic
- "Gingerbread Boy " stories
- Riddles – Jokes and Homophones

- write survey questions
- write thank you letters to the experts
- write web of what they know about chick and eggs

Investigative Skills-Science

*exploring (LS11B1c)

- explore questions such as the following:
  - What is Measurement?
  - How do you measure really light things?
  - What do chicks need to develop in the egg?
- take apart and explore inside a tape measure
- Look and explore with a spring scale that has a see-through cover
- Look and explore inside a clock
- Look and explore inside a computer

*experimenting (LS11A1c, LS11A1f, LS11B1b, and LS11B1d)

- answer questions such as the following:
  - Will beaten egg yolk fluff up more than beaten egg white?
  - Do fertilized eggs weigh more or less than grocery store eggs?

*investigating (LS11A1b)

- How do you measure in music?
- Do you need to measure when making ceramic pots?
- What is wind chill?
- What is day light savings time?
- Why are some eggs brown and some eggs white?

*observing (LS11A1a and LS11A1e)

- dissect and describe parts of tape measure
- observe spring scales
- observe doctors scales
- observe incubator
- observe thermometer
- observe money
- observe clocks and timers
- observe measuring cups and spoons

*predicting (LS11B1a)

- predict materials used in measurement devices before dissection
- predict possible answers to questions formulated before talking to an expert
- predict prior to conducting experiments
- predict purpose of parts of measurement equipment
- predict what kinds of measurement devices are in our school and CRC

- predict what measuring is going on in the neighborhood

*reporting (LS11B1e)
- report the process and results of their experiments
- report what small investigating group found on field site visit

Numeration and Problem Solving

*counting (LS6A1b, LS6D1, LS10B1b)
- count and compare the following:
    - duration or time to run an obstacle course
    - money
    - number of cups or fractions of cups when cooking
    - number of inches, centimeters, pounds, ounces etc. used in measuring
    - number of measuring tools in our school and school building
    - number of non standard units in measuring length and weight
    - tally what they see on their field trips

*estimating

- amount of something (rice, etc.) that would fit into a container
- length, height and width of objects before measuring
- number of days to an event, e.g., hatch a chick
- weight of objects before weighing

*measuring (LS7A1a, LS7A1b, LS7A1d)
- measure distance of obstacle course using a trundle wheel.
- measure the height and depth of the rain puddles, snow drifts, etc.
- measure length of carpet, room, window sill, table tops, chicks and each other, icicles, etc.
- measure number of days until chicks hatch
- measure the following items converting nonstandard measurement to standard measurement by comparing Cuisinaire links, Cuisinaire rods, inches and centimeters
    - carpet
    - window sill
    - length, width, height of room
- measure the temperature of incubator and brooder box
- measure the temperature outside to communicate whether or not students would have an inside or outside recess.
- sheep barn, fire truck, sheep gate, money counter, cash drawer, coil, baler
- use measurement to build representations
- wall quilt about measurement
- weight of classmates, eggs, chicks, pennies, noodles, beans, keys, buttons etc.

*organizing, analyzing, and communicating data (LS10A1a, LS10B1b, and LS10B1c)

- develop bar graphs displaying the results of the survey sent to parents
- develop bar graphs representing data from field trips (e.g., what we saw on walking tour of CRC building, height and weight growth of chicks)
- develop 1-10 rating scale for pets and dessert
- develop pie graphs displaying the results of one of the survey questions sent to parents

*problem-solving (LS6B1, LS6C1a, LS7C1, LS7B1a)

- area of classroom and brooder box
- average height of students in a small group
- calculate distance across the USA

*predicting answers to questions such as the following: (LS10A1b)

- How deep is the snow out in the playground?
- How many people with out stretched arms fit across the USA?
- How much salt will taste good in gingerbread?
- What temperature is the incubator set to hatch chicks?

*surveying (LS10B1a)

- How many scales do you have in your house?
- Do you measure in your house? What?
- How many thermometers do you have in you house?
- Which measuring tools do you have in your house?
-

*using geometry

- analyze geometric relationships
  - 2-dimensional shapes to 3-dimensional shapes
  - drawings of representation to clay models
  - drawings of representation to boxes and junk model

Social, Emotional Growth and Dispositions

*communicating

- engage in group discussion
- frame questions skillfully
- listen to others
- negotiate roles, turn-taking, problems to solve
- report progress of investigations at group meetings
- share research
- use new vocabulary

*cooperating and collaborating while working with others

- prepare displays
- present final reports

- study collaboratively in teams

*empathizing with others and their needs
- appreciate work of peers noting evidence of effort, care and originality
- share friends, materials, space and time
- share praise and appreciation of peers

*enjoying
- cooking and measuring ingredients
- measuring
- talking to experts from different fields of study
- taking care of the chicks
- working with friends on representations

*gaining confidence in abilities to do the following:
- investigate
- make presentations to an audience
- more closely observe people communicating
- remember experiences of measurements
- represent measurement in drawings
- use a variety of mediums to express their ideas

*helping peers
- clean up joint project
- discuss for better understanding
- problem solve
- represent

*initiating
- choose appropriate materials
- experiment
- predict and manage time
- research to answer questions

*persevering

*persisting at a task

*problem solving

*risk taking
- state disagreements in conversations or at group meetings
- support own opinions
- verbalize estimations, predictions, and hypotheses

Who Measures What in Our Neighborhood?

K-1 Classroom

Relationship of Project to Illinois Learning Standards*

Standard 4: Listen and speak effectively in a variety of situations.	
Learning Standards	**Early Elementary**
A. Listen effectively in formal and informal situations.	**4.A.1a** Listen attentively by facing the speaker, making eye contact and paraphrasing what is said. **4.A.1b** Ask questions and respond to questions from the teacher and from group members to improve comprehension. **4.A.1c** Follow oral instructions accurately. **4.A.1d** Use visually oriented and auditorily based media.
B. Speak effectively using language appropriate to the situation and audience.	**4.B.1a** Present brief oral reports, using language and vocabulary appropriate to the message and audience (e.g., show and tell). **4.B.1b** Participate in discussions around a common topic.

Standard 5: Use the language arts to acquire, assess and communicate information.	
Learning Standards	**Early Elementary**
A. Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.	**5.A.1a** Identify questions and gather information. **5.A.1b** Locate information using a variety of resources.
B. Analyze and evaluate information acquired from various sources.	**5.B.1a** Select and organize information from various sources for a specific purpose. **5.B.1b** Cite sources used.
C. Apply acquired information, concepts and ideas to communicate in a variety of formats.	**5.C.1a** Write letters, reports and stories based on acquired information. **5.C.1b** Use print, nonprint, human and technological resources to acquire and use information.

Standard 6: Demonstrate and apply a knowledge and sense of numbers, including numeration and operations (addition, subtraction, multiplication, division), patterns, ratios and proportions.

Learning Standards	Early Elementary
A. Demonstrate knowledge and use of numbers and their representations in a broad range of theoretical and practical settings.	**6.A.1a** Identify whole numbers and compare them using the symbols <, >, or = and the words "less than", "greater than", or "equal to", applying counting, grouping and place value concepts. **6.A.1b** Identify and model fractions using concrete materials and pictorial representations.
B. Investigate, represent and solve problems using number facts, operations (addition, subtraction, multiplication, division) and their properties, algorithms and relationships.	**6.B.1** Solve one- and two-step problems with whole numbers using addition, subtraction, multiplication and division.
C. Compute and estimate using mental mathematics, paper-and-pencil methods, calculators and computers.	**6.C.1a** Select and perform computational procedures to solve problems with whole numbers. **6.C.1b** Show evidence that whole number computational results are correct and/or that estimates are reasonable.
D. Solve problems using comparison of quantities, ratios, proportions and percents.	**6.D.1** Compare the numbers of objects in groups.

Standard 7: Estimate, make and use measurements of objects, quantities and relationships and determine acceptable levels of accuracy.

Learning Standards	Early Elementary
A. Measure and compare quantities using appropriate units, instruments and methods.	**7.A.1a** Measure length, volume and weight/mass using rulers, scales and other appropriate measuring instruments in the customary and metric systems. **7.A.1b** Measure units of time using appropriate instruments (e.g., calendars, clocks, watches—both analog and digital). **7.A.1c** Identify and describe the relative values and relationships among coins and solve addition and subtraction problems using currency. **7.A.1d** Read temperatures to the nearest degree from Celsius and Fahrenheit thermometers.
B. Estimate measurements and determine acceptable levels of accuracy.	**7.B.1a** Given a problem, describe possible methods for estimating a given measure. **7.B.1b** Compare estimated measures to actual measures taken with appropriate measuring instruments.
C. Select and use appropriate technology, instruments and formulas to solve problems, interpret results and communicate findings.	**7.C.1** Determine perimeter and area using concrete materials (e.g., geoboards, square tiles, grids, measurement instruments).

Standard 10: Collect, organize and analyze data using statistical methods; predict results; and interpret uncertainty using concepts of probability.	
Learning Standards	**Early Elementary**
A. Organize, describe and make predictions from existing data.	**10.A.1a** Organize and display data using pictures, tallies, tables, charts or bar graphs. **10.A.1b** Answer questions and make predictions based on given data.
B. Formulate questions, design data collection methods, gather and analyze data and communicate findings.	**10.B.1a** Formulate questions of interest and design surveys or experiments to gather data. **10.B.1b** Collect, organize and describe data using pictures, tallies, tables, charts or bar graphs. **10.B.1c** Analyze data, draw conclusions and communicate the results.
C. Determine, describe and apply the probabilities of events.	**10.C.1a** Describe the concept of probability in relationship to likelihood and chance. **10.C.1b** Systematically list all possible outcomes of a simple one-stage experiment (e.g., the flip of one coin, the toss of one die, the spin of a spinner).

Standard 11: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	
Learning Standards	**Early Elementary**
A. Know and apply the concepts, principles and processes of scientific inquiry.	**11.A.1a** Describe an observed event. **11.A.1b** Develop questions on scientific topics. **11.A.1c** Collect data for investigations using measuring instruments and technologies. **11.A.1d** Record and store data using available technologies. **11.A.1e** Arrange data into logical patterns and describe the patterns. **11.A.1f** Compare observations of individual and group results.
B. Know and apply the concepts, principles and processes of technological design.	**11.B.1a** Given a simple design problem, formulate possible solutions. **11.B.1b** Design a device that will be useful in solving the problem. **11.B.1c** Build the device using the materials and tools provided. **11.B.1d** Test the device and record results using given instruments, techniques and measurement methods. **11.B.1e** Report the design of the device, the test process and the results in solving a given problem.

Standard 13: Understand the relationships among science, technology and society in historical and contemporary contexts.	
Learning Standards	**Early Elementary**
A. Know and apply the accepted practices of science.	**13.A.1a** Use basic safety practices (e.g., not tasting materials without permission, "stop/drop/roll"). **13.A.1b** Explain why similar results are expected when procedures are done the same way. **13.A.1c** Explain how knowledge can be gained by careful observation.
B. Know and apply concepts that describe the interaction between science, technology and society.	**13.B.1a** Explain the uses of common scientific instruments (e.g., ruler, thermometer, balance, probe, computer). **13.B.1b** Explain how using measuring tools improves the accuracy of estimates. **13.B.1c** Describe contributions men and women have made to science and technology. **13.B.1d** Identify and describe ways that science and technology affect people's everyday lives (e.g., transportation, medicine, agriculture, sanitation, communication occupations). **13.B.1e** Demonstrate ways to reduce, reuse and recycle materials.

Standard 25: Know the language of the arts.	
Learning Standards	**Early Elementary**
A. Understand the sensory elements, organizational principles and expressive qualities of the arts.	**25.A.1a Dance:** Identify the elements of personal and shared space, direction in space, quick and slow speed, firm and fine force; the principles of AB choreographic form and sequence; and the expressive qualities of mood and emotion. **25.A.1b Drama:** Understand the elements of acting, locomotor and nonlocomotor movement, vocal and nonvocal sound, story making; the principles of plot, character, setting, problem/resolution and message; and the expressive characteristics of simple emotions. **25.A.1c Music:** Identify differences in elements and expressive qualities (e.g., between fast and slow tempo; loud and soft dynamics; high and low pitch/direction; long and short duration; same and different form, tone color or timbre, and beat). **25.A.1d Visual Arts:** Identify the elements of line, shape, space, color and texture; the principles of repetition and pattern; and the expressive qualities of mood, emotion and pictorial representation.
B. Understand the similarities, distinctions and connections in and among the arts.	**25.B.1** Identify similarities in and among the arts (e.g., pattern, sequence and mood).

Standard 26: Through creating and performing, understand how works of art are produced.	
Learning Standards	**Early Elementary**
A. Understand processes, traditional tools and modern technologies used in the arts.	**26.A.1a Dance:** Understand that the body is the primary tool of dance and identify secondary tools (e.g., pictures, visual aids, words, props and recordings). **26.A.1b Drama:** Understand the tools of body, mind, voice and simple visual/aural media and the processes of planning, practicing and collaborating used to create or perform drama/theatre. **26.A.1c Music:** Identify a variety of sounds and sound sources (e.g., instruments, voices and environmental sounds). **26.A.1d Music:** Relate symbol systems (e.g., icons, syllables, numbers and letters) to musical sounds. **26.A.1e Visual Arts:** Identify media and tools and how to use them in a safe and responsible manner when painting, drawing and constructing.
B. Apply skills and knowledge necessary to create and perform in one or more of the arts.	**26.B.1a Dance:** Perform basic locomotor, non-locomotor movements and traditional dance forms and create simple dance sequences. **26.B.1b Drama:** Demonstrate individual skills (e.g., vocalizing, listening, moving, observing, concentrating) and group skills (e.g., decision making, planning, practicing, spacing) necessary to create or perform story elements and characterizations. **26.B.1c Music:** Sing or play on classroom instruments a variety of music representing diverse cultures and styles. **26.B.1d Visual Arts:** Demonstrate knowledge and skills to create visual works of art using manipulation, eye-hand coordination, building and imagination.

* Illinois Learning Standards available online at http://www.isbe.state.il.us/ils/standards.html