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Extending the dimensions of science through poetry

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One of the goals of an integrated program for fifth grade was to integrate literature-based language arts with science. The connection of the language arts and science areas offered children opportunities to engage in the language processes within the functions of language offered in the science area. Through reading and writing poetry and conducting experiments in science, the children learned science concepts and related vocabulary. As children listened to poetry, they were directed to focus on images enlarged upon by the sensory elements of the poetry. Such a perspective is related to the task of observation in the science process. Comparing the aspects of two images in a poem through figurative language provided in-depth learning experiences.

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Abstract

The primary function of poetry is to bring enjoyment, but poetry can also foster concept development in an instructional program that extends literature across the curriculum. Poetry as part of a literature base can assist in integrating the areas of the school curriculum. Because of its intense emotional quality and sharp images, it can assist in connecting children's prior knowledge with new concepts.

One of the goals of an integrated program for fifth grade was to integrate literature-based language arts with science. The connection of the language arts and science areas offered children opportunities to engage in the language processes within the functions of language offered in the science area. Through reading and writing poetry and conducting experiments in science, the children learned science concepts and related vocabulary. As children listened to poetry, they were directed to focus on images enlarged upon by the sensory elements of the poetry. Such a perspective is related to the task of observation in the science process. Comparing the aspects of two images in a poem through figurative language provided in-depth learning experiences.

Poetry is a celebration of the world. Poets are like scientists. Many poems are sparked by observations and, in turn, stimulate the audience to think and imagine (Heard, 1999). Poetry creates an image that helps the reader experience the emotions that the writer experiences (Butzow & Butzow, 1989).

Poetry Inclusion in the Science Curriculum

Literature experiences can greatly enhance the school program. Such experiences can serve as a catalyst to link the language arts and science areas. Poetry can be a source of meaningful learning experiences in the science program. Poetry can often reveal something quite unexpected in the midst of the familiar and ordinary. Worth (1994) relates, "Poets make it their job to pay attention to and write about things that are hiding around corners or that are mysterious" (p. 569). Thus, poetry can support the study of science as viewed by Carl Sagan: He believes that science is more than accumulating information, but also encouraging wonderment, curiosity, openness to new ideas and skepticism. He states, "The prime motive of science is to provide children with a variety of ways of finding out about the world and themselves through investigation" (1978, 175). Both science and poetry support the same goal: Both poetry and science are using processes to inspire wonder about the world around them. Thus, poetry can extend the dimension of science study and also the integration of the language arts and the science areas (Langer, 1995).

The integration of the language arts and science areas through a literature base allows each area to maintain its integrity though the learning processes of both areas are similar. This interdisciplinary approach to science allows learners to be involved in investigation and manipulation of ideas and materials to develop science understandings. The language arts processes (oral and written) support the investigation of science providing the tasks of observing, recording, comparing, measuring, using time/space relationships, interpreting, discussing, predicting outcomes, making judgments and evaluating (by Dickinson, 1998; Butzow & Butzow, 1989).

Children make sense of their world by being allowed to make mistakes and to self correct as they learn to comprehend and relate science understandings to their own lives through language. Completing the science process of exploration with writing and illustrating poetry can be a means of explaining their involvement in the process to themselves and others. Ladd (1994) states that writing and illustrating poetry can help children demonstrate how clearly a science concept is understood and also can help clarify its image in their minds.

A study in Mt. Pleasant, Michigan with middle school students concluded that poetry extends the science program. Poetry assisted

students in integrating new science understanding into their store of knowledge (Fisher, 1980).

Children using their background knowledge and the new information that they have gained through involvement in the science processes can make connections to their own personal knowledge and values. McClure (1999) suggests that it is a desirable practice to introduce and conclude science lessons with poetry or lyrical prose that can connect the aesthetic with the facts of science inquiry. She relates, "Teachers need to help children look beyond just the facts to discover and reach aesthetic dimensions that both include and move children into new worlds of our natural environment" (p. 341).

Implementation of Poetry into a Science Program for Grade Five

The lessons from the fifth grade science program were presented in this article based on this premise: Students' natural curiosity will be the catalyst for developing scientific literacy. This literacy involved the acquisition of scientific knowledge and the ability to understand and apply scientific decisions to students' daily lives. The program emphasized inquiry-based and activity-centered lessons. Students in all grade levels should understand the relationship of science to other areas of the curriculum and the impact that it holds on their lives and the world.

The lessons delivered were pre-determined lessons in a unit set up by Omaha Public Schools science coordinators to build science processing skills. The science process tasks that were taught in the lesson were taken from a commercially-prepared program Science Process Skills: Assessing Hands-On Student Performance, by K. Ostlund, 1992. The example lessons in this article were representative of the many science process tasks in the program.

The National Science Education Standards (1996) that were applied to the lessons were Scientific Inquiry-Level II.

- Scientific investigations involve asking and answering questions.
- Scientists use different kinds of investigations.
- Simple investigations are conducted.
- Simple equipment and tools are used to gather scientific data that extend the senses.
- Different people interpret the same set of observations differently.
- Scientists review and ask questions about the results of other scientists' work.

In integrating literature-based language arts into the science program, the National Language Arts Education Standards (1996), Level II were implemented.

- Writes expressive compositions (reflections, observations, narrative strategies and relevant details and ideas)
- Writes in response to literature (support judgments, reference to text and other works, knowledge from a text that supports personal knowledge)
- Makes simple inferences regarding the order of events and possible outcomes
- Identifies the main ideas or theme of a story or text
- Relates stories or facts to personal experiences
- Uses new information to adjust and extend personal knowledge base
- Draws conclusions and makes inferences based on explicit and implicit information in texts
- Differentiates between fact and opinion in informational texts
- Summarizes and paraphrases information in texts

In the teacher-directed lessons, many science process tasks that were taught overlapped with the language arts tasks (Ostlund, 1992). The science process tasks are given below:

- *Observing:* Using one or more of the five senses to gather information.
- *Communicating:* Giving or exchanging information verbally, orally, and/or in writing.

- *Estimating:* Approximately calculating a quantity or value - based on judgment.
- *Measuring:* Comparing objects to arbitrary units that may or may not be standardized.
- *Collecting Data:* Gathering information about observations and measurement in a systematic way.
- *Classifying:* Grouping or ordering objects or events according to an established scheme.
- *Inferring:* Developing ideas based on observations.
- *Defining Operationally:* Stating specific information about an object or phenomena based on experiences with it.
- *Investigating:* Using observations to collect and analyze data to draw conclusions in order to solve a problem.

The lessons that brought poetry into the science study involved oral language experiences (listening and speaking) and written language experiences (reading and writing). The teacher presented many read aloud experiences to the students. They responded through reading alouds, follow alongs, silent reading, echo reading, choral reading, poetry with two voices, and group presentations. Read alouds involved a group reading a poem usually presented on a chart sheet. Follow alongs presented the listener with a visual as a poem was read. Silent readings, through limiting the

experiences of the song of the language in a poem, gave a reader the experience of interpreting the meaning of the selection independently. Echo readings involved repeating words or phrases of a poem as they are read by one or more voices. Choral speaking was the reading aloud of poetry by a whole group, small groups, single persons, or a combination. Poetry for two voices requires two voices or two groups of voices interpreting aloud a poem. Group presentations combined speaking with dramatization and movement (Larrick, 1991).

The children were presented different forms of poetry. Particular forms of poetry writing were encouraged with specific science lessons.

Examples of science lessons and related poetry experiences are presented in the following pages. Poetry experiences were part of the lessons' introductions and also a part of their conclusions. The science process tasks overlapped with language arts tasks in many instances.

The unit on acquiring science process tasks presented projects that required students to measure and record data that included charting, graphing, individual record keeping, drawing, and diagramming. The activities were designed so that the students engaged in the roles of thinkers, investigators, researchers, scientists, and poets. The welding of literature and science allowed the students to view science from their perspectives and to relate their emotional responses to the real world and

to their imagination. The teachers' responsibility was to give the lessons their shape and credibility. Poetry was used to introduce concepts; then the objectives and procedures of the lesson offered opportunities to engage in the science tasks. These lessons were followed by hands-on experiments. To conclude the lessons, students were encouraged to use a form of poetry writing to record the results of the science lesson in their science journal. Children were introduced to new forms of poetry writing with each lesson, but were never required to write in any particular form. Students could write in free verse if they chose. Examples of the lessons are presented below and include the children's poetry compositions.

Food Science: Defining Operationally

The objective of science process task lesson, defining operationally, was to build experiences based on hands-on experiments with an object or a phenomenon, in this case, determining what foods might be carbohydrates. In the introductory lesson, the poems from "Munching" and "Poem Stew" (by Cole, W., New York: Harper, 1981) were read aloud by the teacher and the students from chart sheets. Students were asked to think why food is essential for life. Their responses were recorded on a chart for reference. After prior knowledge was established, the objective was given: To determine which foods were carbohydrates. Students were told that any food that turns blue/black when iodine is dropped on it with

an eyedropper is a carbohydrate. It was discovered that potatoes, crackers, bread, and pasta were all carbohydrates, all of which provide the body with quick energy. Referring to the chart and the introductory poems, the children noted that their list of foods provides energy. These foods are one essential reason why food is important.

The lesson concluded with an opportunity to write terse verse and to focus on the element of alliteration though the children were free to create meaning through other forms and elements. Terse verse and alliteration poetry were selected to encourage students to rhyme scientific results into a poetry pattern. Terse verse is a short poem with a long title or introduction. Alliteration is the sound repetition of an initial sound or sounds in two or more words. Images to be addressed were carbohydrates and their importance to the body.

The poems presented by the teacher aloud on chart sheets were "potatoes," from all the small poems and fourteen more (Worth, V., Farrar, 1994) and "Oodles of Noodles," by Lucia and James R. Hymas, Jr., from The Random House Book of Poetry for Children (by Prelutsky, J., ed., New York: Random House, 1983).

Examples of the fifth graders' responses are given below:

A small, not nice vegetable
Mean Bean

Carbohydrates give us this
Quick Fix

Humpty Dumpty sat on a wall
Humpty Dumpty had a great fall
All the king's horses and all the king's men said . . .
Yum! Energy comes from carbohydrates.
Potatoes, crackers, pasta, and bread.

Quick Energy
All you do is get some food.
A little iodine will do,
Then dip drop and then stop.
If your food turns black on top,
you will see that your food is just a carbohydrate
which is really great for you and me.

White Powder Mystery: Investigation

Investigation was the science process task delivered in the next lesson. Poetry that expressed wonder and puzzlement were presented aloud from chart sheets by the teacher and the students. These poems from I Think That it is Wonderful (by Korr, D., New York: Western Publishing, 1984) and Poetry Place Anthology (by Alexander, R., New York: Scholastic, 1983) were shared. From these poems, the children recorded words that describe wonder or puzzlement on a chart sheet. Then, the science lesson on investigation was presented. Investigation was defined to the students as using observations to collect and analyze data in order to draw conclusions to solve a problem. The process lesson investigated which white powder was baking soda by

adding a drop of vinegar to it. Baking soda will fizzle. The students explored the four white powders and discovered baking soda powder.

In closing, students expressed the results through poetry. The students could use free verse or quatrain. Quatrain is a four-line poem that may follow any one of four different rhyme patterns (AABB, ABAB, ABBA, or ABCB) and that focuses on a concept, in this case, baking soda.

Examples of the students' poems are given below:

Baking soda, baking soda
you will bubble with vinegar.
It reminds me when I shake a soda.
Fizzle, fizzle, watch the chemical reaction.

Don't look now,
Cause here comes . . . .
Salt the sharp and tough.
Powdered sugar light, soft and sweet tasting,
Flour has a clump of dough that turns light
and fluffy in our bread.
And last but surely not least,
Baking soda!
All bubbly and mad,
looks like the soap I see when I take a bath.

Animal Movement: Communication

The objective of this science process task was communication: to build science concepts and related vocabularies and to enable students to view scientific objects critically. As part of the introduction, the poem "Jump or Jiggle," from the book of children's poems, Poems to Read to the Very Young, (by Frank, J. New York: Random House, 1977), was read aloud. To build

students' prior knowledge, they were given a number of Zoobook Magazines and were instructed to find and clip out pictures of animals that move in different ways. Then, the students were instructed to divide a piece of paper into four sections and list one form of movement in each box. The students exchanged information orally about the different movements of animals. They went about the room exchanging pictures and information on the movements of animals. Then, they glued pictures of animals under each corresponding section on the folded paper. Some children traded pictures.

In the conclusion of this lesson, students were encouraged to write free verse, couplets, or triplets in reflecting on the different movements of animals. The students were given form information and examples of couplets and triplets: A couplet is a two-line poem that rhymes, a triplet is a three-line poem that rhymes. An example of a series of couplets is "Jump or Jiggle," from Poems to Read to the Very Young (by Frank, J., New York: Random House, 1977). An example of a series of triplets is "Three Signs of Spring," from The Star in the Pail (by McCord, D. Little, Brown, 1975).

Examples of student responses are presented below:

Starfish, starfish in the ocean
Moving along in slow motion

Up, up, up in flight
Sails my rainbow kite.
What a pretty sight.

This lesson was extended with a lesson on animal tracks. This concept was extended by reading aloud the poem "Animal Tracks," (by Goldish, M., New York: Scholastic, 1995). In this lesson, animal track cards were used to investigate animal footprints. Students observed carefully the different attributes of each track and how they matched the way the animal moved, such as the duck with its webbed feet which helped it be a good swimmer. In conclusion, the students were instructed to connect each animal track with the animal that made that track. The poem from Science Poems (by Goldish, M., New York: Scholastic, 1996) connected well with this lesson.

Rock Classifying: Categorization

The lesson on this science process task involved observing a group or an order of objects or events and categorizing them according to an established scheme. In the introduction of this task, "My Pet Rock," from One Day at a Time (by McCord, D., Boston: Little, Brown, 1929) was read aloud to the class. The students were to select a pet rock for their own from a collection in the room. The students were paired for the categorization tasks: They were to sort stones into two groups by placing the stones in labeled circles. The labels of each circle represented different attributes of the stones. Finally, the students explained how the stones in each group were alike and different. In closing, poetry was connected to the lesson through haiku poetry. Haiku poetry was selected to integrate the children's categorization

activity and nature elements. This poetry form has three lines with a 5,7,5 syllable pattern. The students had an option of using haiku or other forms to reflect on their involvement in the categorization process. Poems from Flower Moon Snow (by Mizumura, K., New York: Crowell, 1977) were used to present haiku poetry.

Examples of children's responses were:

The hungry frog
resting on a lily pad
dreams of careless flies

Loud, crashing thunder
And then the rain pouring down
The rainbow appears

Color Wheel: Inference

The lesson objective for the inference task was to develop ideas based on observations that require students to evaluate the results and to connect them to past experiences, or prior knowledge. From their crayon box, the students were asked to select their favorite color. Then, they were instructed to pull out the primary colors - - red, blue, and yellow - - and create three other colors, or secondary colors. From this activity, the students could infer that by mixing the primary colors, they could produce the secondary colors that completed the color wheel. When students completed the color wheel, they recorded which primary colors were mixed to obtain the secondary colors and gave reasons for the arrangement of the color wheel.

To extend this lesson, the teacher shared poems aloud from the book Hailstone and Halibut Bones (by O'Neil, M., New York: Random House, 1961). The students were asked to reflect on the color they had chosen at the beginning of the lesson. Then, students were asked to close their eyes and visualize items that represent that color. From these visualizations, the elements of sensory awareness was connected - - sight, sound, touch, smell, and taste. Some of these poems were reread to discuss figurative language - - metaphors and similies.

To conclude the lesson, the students were encouraged to use the forms of poetry cinquain and diamante to record the results. The teacher guided the class through composing cinquains and diamantes. Cinquain, a form with five lines, starts with the name of an image on line 1. On lines 2, 3, and 4, a word is added to each line in response to the word on line 1. The fifth line contains a synonym or a summary word of the image on line 1. The diamante focuses on change with two opposite concepts – one written on line 1 and the other written on line 7. The poem starts with a word or phrase and expands until line 4 is the longest line and addresses the change in the concepts. Then, the last three lines gradually diminish to a word or two on the seventh line. The shape of the seven lines gives the appearance of a diamond.

Students wrote these poems presented below:

What is Blue?
Blue is the color of coolness in the night.
It's the color of the roaring sea.
Blue is the color of a letdown feeling
also the color of sky.
Blue is the color of falling tears from a sad face,
the color of my dad's t-shirt.
Blue is the color of cold ice touching skin
or the color in a child's eye.

Blue
Blue is the color of the sky,
Blue is inside of blueberry pie.
Blue is the water in the stream,
Blue is my sweater or the seam,
Blue is very strong and bold.
Blue is a simple tear.
Blue is this very year.
Blue is someone very sad.
Blue is a balloon I had.
Blue is my favorite color.

Heads and Tails: Prediction

The objective of the lesson on the prediction task was to help the students form an idea of an expected result based on inferences. The teacher and the students discussed the meaning of prediction. The poem, "Coins" from all the small poems and fourteen more (by Worth, V., Farrar, 1994) was used to introduce this lesson. A lesson on probability was given using a penny that was flipped forty times. The students recorded whether the coin landed on which side - - heads or tails - - as it was tossed. After the results were recorded on graph paper, the students used the results of the forty-coin flips

to predict what would happen if the coin was flipped ten more times. In conclusion, students browsed through poetry books and searched for poetry that would express the meaning of prediction/probability. These poems were recorded in their science journals.

An extension of poetry writing was introduced. The teacher gave explanations of share poems and alphabet poems. Shape poems are written in the shape of an image. Alphabet poems address the image spelled vertically with each line referring to the image. These forms could be used as options in reflecting on this task lesson. Examples were written by the teacher and students to explore the forms before the students wrote their own.

Examples of students' alphabet poems are given below:

Dice fall
It doesn't matter how
Cause they roll and tumble
Each landing on only one side.

Pennies are worth one cent

Each penny has two sides

Never do you know how they will fall

Never do you have a penny when you need one.

Everytime you need a penny you can't find one

Some pennies bring good luck.

Parts of a Tree: Diagrams

The objective of science process tasks lesson on diagrams was to develop a physical or mental representation to explain an idea, object, or event. First, this poem, by Sara Coleridge, "Trees," from The Random House Book of Poetry for Children (by Prelutsky, J., ed., New York: Random House, 1983) was read aloud to the children. Then, the class went on a walk to view trees and then to select one to focus on. On returning to the classroom, they wrote a description of their trees and the environment surrounding the trees in their journals. Each student made a model of their tree and attached labels to its parts, such as the root, stem, flower, fruit, seed, and leaf.

In conclusion, the teacher explained how to write lantern poetry: a five-line poem that is written in the shape of a Japanese lantern. This option for reflecting on trees, their parts, and their environment was experimented as a class with the support of the teacher before the students began to write.

Conclusions

The students responded to the lessons on science process tasks with creativity and imagination. They incorporated personal knowledge with that of new science knowledge. Poetry broadened and intensified their experiences. It delighted the children while helping them to develop new insights and ways of sensing the world around them. The use of poetry in the science curriculum strengthened students' concept development and related vocabulary as was indicated in their writing. Students were eager to search for poems and write poems that expressed their learning.

The experiences of listening/reading poetry improved their language abilities. These listening and reading experiences provided children with opportunities to explore and discover the scientific world and to develop higher levels of achievement. The integration of poetry into the science area provided vicarious experiences and helped students feel like science was a real part of life not just an academic area.

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