1992

Facilitating science understandings through whole language

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Abstract

The purpose of this paper is to consider extending the language arts across the elementary school curriculum to the science area in order to facilitate children's growth in language abilities and in knowledge of science concepts and processes. Supporting this study will be a review of the current status of science programs in the elementary schools and the value of the whole language concept in instructional development. Based on this review, the paper will present ways that the language arts can be integrated into the science program.

Facilitating Science Understandings Through Whole Language

A Graduate Project

Submitted to the

Department of Curriculum and Instruction

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Education

UNIVERSITY OF NORTHERN IOWA

by

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May 1992

This Research Paper by: Shirleen Larson Reinhardt

Entitled: Facilitating Science Understandings Through Whole Language

has been approved as meeting the research paper requirement for the Degree of Master of Arts in Education.

5/8/92
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The whole language concept has gained much attention in the past decade as researchers and practitioners have sought to improve language instruction by focusing on the nature of language and children's developmental language abilities. Through creating their own meaning while engaging in the language processes and participating in the functions of language, children develop thinking-language abilities. Whole units of language, stories and poems, offer a framework in which children can more easily create meaning.

Children's involvement in the functions of language nurtures their interest in engaging in the language processes and therefore their abilities to process content. Opportunities to become meaningfully involved in the functions of language can be offered by extending the language arts across the curriculum. Even though the whole language concept encourages the integration of the language arts with other areas of study, little research has been conducted to ascertain the effectiveness of this practice in science instruction.

Purpose of the Study

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current status of science programs in the elementary schools and the value of the whole language concept in instructional development. Based on this review, the paper will present ways that the language arts can be integrated into the science program.

Science Programs and the Whole Language Concept

In this section the current status of school science programs and the value of extending the whole language concept across the curriculum will be discussed.

Current Status of Science Education

Cultural literacy in today's society includes an understanding of science and technology. Even though these areas affect everyone in vital ways, the typical elementary science program does little to enhance such literacy. Students study science, yet see little usefulness for this knowledge in their daily lives. Understanding this connection is essential to success in science education. Attitudes towards science study, science classes, science teachers, and science careers become more negative as students progress through their elementary and secondary years (Yager & Penick, 1986).

Renner and Yager (1980) have addressed the problems in science education and have proposed some solutions. These are the suggestions they have offered teachers for developing effective science programs in the elementary school: (a) extend

their own understanding of the learning process, (b) identify traits, skills, and attitudes of scientifically literate persons, (c) concentrate on students' understandings of the problems facing their current culture, and (d) stress to students and to the community that achieving the goals of the science program also enhances learning in other curricular areas.

The use of textbooks as the primary source of instruction has been identified, by Harms and Yager (1981), as another problem of the elementary science program. Textbooks do not provoke students' creativity, yet 95 percent of instruction is provided through this means. The thinking abilities that can be acquired through a science program are achieved through whetting students' curiosity and offering them opportunities to engage in the inquiry processes.

In science education, much dialogue has been centered on preparing for change in the future, for the current American culture is experiencing rapid change and advancement in science and technology. Schools need to make science and technology more useful to individuals so they can better direct their own lives, act with civic responsibility, and anticipate and react to world changes (Holdzkom & Lutz, 1985). Motz and Madrazo (1988) propose that this emphasis on science learning be carried out through a program that stresses the relationships among

science, society, and human needs. Children need to be able to use science to improve their lives. They need to acquire the capabilities that will enable them to process ideas, to inquire and solve problems, to be aware of careers, and to recognize value-laden judgments. Programs should meet personal needs, help resolve societal problems, build career awareness, and prepare for further study.

After the launching of the Russian satellite in the sixties, a trend emerged to make science more exciting and real. This trend, for the most part, was not implemented in the elementary school (Penick, 1982). Instruction continues to emphasize the reading of textbook materials and the memorization of facts. Harms and Yager (1981) relate that concepts are often presented in an abstract manner. Little opportunity is given to students to engage in learning by experience or through process. A single text or program is used by 56 percent of teachers in grades four through six. By the end of the elementary years, most students will have had only one teacher who gives a substantial share of the curriculum to science and is knowledgeable of this curricular area.

Much of science instruction now includes discussion and lecture (Holdzkom & Lutz, 1985). Demonstrations are used about two times per week. Student projects in the form of reports are in evidence approximately once per month. Textbooks discourage

inquiry yet are used a majority of the time. Most instruction takes place in large groups. It appears that there is almost a disappearance of study through the science processes (Motz & Madrazo, 1988). Meanwhile, students are devising "homegrown" theories early and continue to rely upon these ideas that are often misconceptions. Also, science is a limited program which is usually presented at the end of the day with little time allotted and by a teacher with little interest in the topic (Penick, 1982).

A study of nine-year-old students' understanding of their school science programs, conducted by Harms and Yager (1981), revealed that programs are not in line with students' interests and are not nurturing their abilities and interests in science. Ninety percent of these nine-year-olds stated that their teachers asked them questions about science. Seventy-three percent of the students said that the teachers encouraged them to ask questions about science. Ninety-three percent responded that they liked exploring ideas and processes independently while sixty-one percent would rather be told answers than to find the answers. Seventy-seven percent did not like questions that they could not answer, and only fifty-seven percent said they would like more science.

Harms and Yager (1981) have given suggestions for instructional delivery in elementary science programs. They

relate, "Because language grows in the context of experience, so the language of science needs to be learned in the context of experience with science." Instructional programs need to reflect how children learn. Children in the elementary grades are naturally curious about the universe and their environment; therefore, this is the time they should be developing basic attitudes, thoughts, and behaviors about their world. The elementary years are a time to promote curiosity and to build interest in and to practice scientific methods. Motz and Madrazo (1988) collaborate with this view. They relate that "an integrated, hands-on approach is needed, which focuses on the relationships between humans and the total environment. Problem solving must be emphasized, including acquisition and analysis of data."

In restructuring the science program to bring about these changes, teachers need to examine the curriculum and to revise the program to promote the interrelationships among human beings, natural phenomena, advancements in science and technology, and the quality of life (Hurd, 1986). The thinking processes that are involved in understanding relationships need to be carefully considered and to become an integral part of the instruction (Harms & Yager, 1981).

Science needs to be viewed as a "basic" just as reading, writing, and mathematics. It should not be an exercise in

reading comprehension but a vehicle for learning about oneself in relation to the world (Harms & Yager, 1981).

To improve science instruction, teachers should be given the ownership for their programs; in other words, they should be given more responsibility for the delivery of the program. The textbook should not be the science program. Content and sequence of presentation are relevant in terms of community and societal issues. Also the community, administration, and parents should be involved in the planning of the science program.

Project Synthesis (Harms & Yager, 1981), which was a joint effort of a committee representing a wide variety of roles and perspectives within the science community, suggested a course of action for improving science education in the United States. The following are the seven priorities that require immediate attention.

1. A major redefinition and reformulation of goals for science education
2. A new conceptualization of the science curriculum to meet new goals
3. New programs and procedures for preparation, certification, assignment, and the continuing education of teachers
4. New materials to exemplify new philosophy, new curriculum structure, new teacher strategies

5. A means for translating new research findings into programs for affecting practice
6. Renewed attention to the significance of evaluation in science education
7. Much greater attention to development of systems for implementation and support for exemplary teaching and programs at local level.

Value of Whole Language in the Science Program

The concept of whole language means that all language is relative to a learner's interests and concerns, and instructional programs need to reflect this view. Whole language is not based on materials but on the language functions and processes. Knowledge, thought, and learning are social and involve collaboration with one's own thoughts and those of others. To promote the whole language concept, an instructional program needs to be child-centered and to offer a print-rich environment with both teacher presentations and student-determined activities (Slaughter, 1988). The teacher and the learning environment needs to encourage risk-taking (Goodman, 1986).

The whole language concept in focusing on children creating their own meaning through the language processes is carried out through whole units of language. Stories and poems offer a structure in which children can respond through listening and reading and in their speaking and writing.

According to Huck (1987), literature experiences that can extend the whole language concept are the reading aloud of quality works by the teacher, self-selected reading by the students, the discussion of student reading with their peers and teacher, provision for works representative of the different genres in all curricular areas, and many opportunities for children to connect the ideas they have generated from literature experiences with a whole array of options for expression.

Thais (1986) relates that the learning environment can greatly enhance literacy with many resources and centers and with opportunities to engage in the language functions. Hansen (1987) considers time, choice, and response as critical considerations in developing a child-centered learning environment. Also collaboration with peers and the teacher enhances understandings and abilities. Ideas can be extended and clarified through sharing and discussing with others.

Incorporating the whole language concept into the science program can enhance the learning of language and science. Literature experiences can help students make sense of themselves in the world.

Integrating the Language Processes into the Science Program

Language serves as an instrument of thought. Through engaging in the language processes while exploring science concepts, students create meaning thus strengthening their thinking-language abilities and their understanding of science. The science area offers interesting content and tasks to fuel children's need to engage in the language functions. In such an approach that integrates the learning processes, children observe, use prior knowledge, predict, research, question, and record.

Reading

Engaging in the process of reading within a content area lends to the development of thinking-language abilities and learning about the world. Applying the whole language concept to reading in the science area gives students opportunities to study science themes through literature (Sullivan, 1986). Science units can become more meaningful to children through reading a variety of genres and extending understanding through expressive activities. Informational reading encourages the development of in-depth understandings. Literature experiences individualize concepts for a wide variety of student prior knowledge (Holmes & Roser, 1987).

Real readers meet books not only in reading class but in the subject areas. Content resources from the different genres provide depth and richness of detail and up-to-date information. Both fact and fiction will provide a unique human perspective on science subjects. Reading in the content area will provide growth in children's appreciation for good reading and writing and development of concepts in the curricular area (Huck, Hepler, & Hickman, 1987).

From reading experiences with the different genres, students pick topics, select books, and plan activities with the assistance of the teacher. Webbing can extend students' science understanding, identifying subtopics and their interrelationships. Weaver (1990) relates that varying forms can be used to fit the different needs, ages, story forms, and intentions of the teacher. They can involve students in higher order thinking skills. Webs lend themselves to comprehending relationships of cause-effect, event cycles, comparison and contrast, character development, and story grammar. Calkins (1986) adds that webbing can aid students in brainstorming various topics for writing on or help students to outline chapters read.

Writing

Writing is another component in extending the whole language concept into the science program. In the content areas,

such as science, much of the writing is mechanical writing--formal compositions, and essay exams. Students in the process of writing can learn to activate prior knowledge, build organizers, reread, and requestion through writing (Calkins, 1986).

Integrating writing into the science curriculum can take many forms (Martin, 1975). Involvement in the content and the processes fuels ideas for stories (expository and fiction) and poetry. Through writing logs, students can record the process and the results of their learning. Students can also ask questions about the concepts encountered, make guesses, and organize information that can activate prior knowledge. Students can reread their logs and reconsider their thoughts (Calkins, 1986).

Calkins (1986) states that writing can be used as a tool in doing research to facilitate learning. Students can achieve ownership by selecting a science concept to be researched. In preparing for writing, they can get ideas for prewriting by watching films and reading. They can plan by taking notes, asking questions of others, and answering their own. While moving in a recursive manner through the writing process, they will extend their pursuit of meaning through drafting and redrafting to clarify their ideas, revising to focus on form, and then publishing the final draft (Beutler, 1988). At the

end of the investigations, writings can be shared in various ways, such as a class book, individual publications, and inviting audiences to view videotaping or audio recording, to name a few (Calkins, 1986).

Science Learning Centers

The science instructional program should be based on learning through process. For example, the Science/Technology/Society Model (Yager, 1985) is based on student selection of problems to investigate and includes various individual and group actions. This approach to learning science concepts through involvement in the processes parallels, in many ways, the whole language concept--creating meaning through the comprehension and composition processes.

Laminack (1987) relates that concepts in science are best learned through direct experiences rather than indirect experiences such as reading from a textbook. Experiences accompanied by peer interchanges enhance cognitive and language development, concurrently. Children need opportunities to explore, experience, interact, organize, classify, compare, measure, predict, observe, infer, draw conclusions, write, and read. These experiences enable and encourage students to read and write to learn. Harms and Lettow (1986) relate that children delving into many sources, other than that provided by the traditional one textbook approach, can have opportunities

to explore areas of individual interest and use higher order thinking skills.

Learning centers provide many opportunities for students to investigate ideas through the learning processes. They allow students to select their own activity. Centers with a literature base can offer models of language and can enrich the learning experience. Two types of centers that can extend the learning environment are sustaining centers and centers specific to the units. Sustaining centers are ones that are maintained throughout the school year with their contents reflecting the particular study of the units. They offer a secure, predictable structure to the classroom. Both sustaining centers and centers specific to the unit can present literature-based language activity focused on the particular area of the science unit (Harms & Lettow, 1992).

As the science units are developed, students need to be introduced to the potential for exploration, explanation, demonstration, and learning in the center. Such teacher introduction can greatly enhance students' involvement. During center work, cooperative groups (pairs, threes, or fours) can function with much peer interaction through the science and language processes (Harms & Lettow, 1992).

Sustaining centers. These sustaining centers can serve as structure for a learning environment (Harms & Lettow, 1992).

A reading/listening center is a collection of literature works and accompanying tapes to enhance science understanding and language learning. It presents works from the different genres associated with the units of study. Recorded works can give students the opportunity to hear language and to gain understandings if they are unable to read the text. Student-authored pieces are a favorite part of the reading/listening center.

A poetry center includes a variety of kinds and forms of poetry that offer responses to the emotions in experiences. Collections of poetry and tapes pertaining to the science units, as well as works of individual poets, can be available in this center. Poetry can assist children in viewing their world not only in new ways but with a keener awareness.

The author/illustrator center provides a comprehension/composition connection focusing on the works of a particular author/illustrator with information showing the relationship of the works to the life experiences of the author/illustrator and the composition process engaged in to create the works. This information can consist of biographical sketches, journal articles, and correspondence with author/illustrator.

The sensory awareness center provides sensory activities (sight, sound, touch, smell, and taste) that extend experiences with the world around. Books with well developed imagery and

poem collections provide literature resources. Objects on display can be explored through the different senses.

Ways to share literature can be compiled in a "How to Share Books Center" and can be used as a reference. Students enjoy sharing ideas gained through literature experiences. Some examples include creating displays, book jackets, bookmarks, puppets, games, and letters.

The poetry forms center serves as a reference for poetry composition. It offers explanations and examples of different forms.

A storytelling center includes ways to retell stories through speaking, dramatizing, writing, and illustrating. Some suggested experiences are composing endings for open-ended stories, providing the text for minimal or no-text works, and other activities representing different forms of retelling.

The bookmaking center can include specific directions for the construction of various book types--shape books, accordian folds and flaps books--and of different kinds of pages--cutouts and alternating full and half pages, either vertically or horizontally. Well-designed books offer models of how the different parts--covers, endpapers, blank leaves, dedication page, illuminated letters, and borders--can be used to amplify the meaning of the text.

Centers specific to a unit. For each science unit, centers, some of them with a literature base representing the different genres, can extend the study. To provide for easy identification, each center needs a title. Using the study of weather as an example, these literature-based centers can be presented to grades two to four.

Title: Weather Lore

Literature Experience

Read some of these folk tales that explain the forces of weather.

Expressive Activity

(1) Interview older people concerning tales and sayings they have heard about weather.

(2) Decide whether these stories have a scientific basis. Prepare a poster with the sayings related to weather.

Title: Poems! Poems!

Literature Experience

Read poems with weather images from this list of sources.

Go With the Poem, by Lilian Moore

A Sky Full of Poems, by Eve Merriam

Flashlight, by Judith Thurman

Snowman Sniffles, by N. M. Bodecker

The Sky Is Full of Song, compiled by Lee Bennett Hopkins

Flower Moon Snow, by Kazue Mizumura

Magic Lights and Streets of Shining Jets, compiled by Dennis Saunders

Poetry of the Earth, compiled by Adrienne Adams

Something New Begins, by Lilian Moore

Expressive Activity

Draw or find a picture of a weather condition. Compose a concrete poem to accompany the drawing or picture.

Title: Describe It

Literature Experience

Read Hide and Seek Fog, by Alvin Tresselt

Expressive Activity

The author uses imagery to describe the fog. Use words from the book and/or your own to write a cinquain about an element of weather.

Title: Weather, the Storm

Literature Experience

Read The Storm Book, by Charlotte Zolotow

Expressive Activity

Tell a friend or write about an experience you have weathered during a storm.

Title: Adventure With Snow

Literature Experience

Read The Snowy Day, by Ezra Jack Keats.

Expressive Activity

Write about the pocket adventure from the snowball's point of view.

Title: Weather Book

Literature Experience

Read The Cloud Book, by Tomie dePaola

Expressive Activity

Divide a sheet of paper into fourths to make four frames. Write a weather story as dePaola had done in The Cloud Book.

Title: Storms

Literature Experience

Read Storm In The Night, by Mary Stolz.

Expressive Activity

(1) Add storm sound effects as you read or retell this story into a tape recorder.

(2) Interview a grandparent or older friend about an experience they have had during a storm.

Summary

Science programs in the elementary school are in great need of instructional development. One way to enhance science learning is to integrate the whole language concept into the science program. Students' involvement in the language processes, not only strengthens their verbal literacy, but supports their development in the science area. A literature base with works from the different genres enriches the study by supporting the investigation of science concepts and emerging thinking abilities.

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