

Engineering a Poem: An Action Research Study

Janice Koch and Brooke Feingold

Overview

This study explores the use of design technology to teach a unit on poetry in a fifth grade class. The main goals of the poetry unit were to develop students' abilities to use their own creative voices to express themselves and to write descriptive poetry that creates detailed images for the reader. To reinforce the latter concept, the teacher used a design challenge that asked these fifth grade students to make a three dimensional representation of the imagery created by another student's poetry. The students' experiences of being immersed in design and construction revealed engagement and attention to detail. Their abilities to meet the design specifications and constraints of this challenge were observed and researched by the classroom teacher. The students' understanding of imagery, appreciation of poetry, and their ability to write poetry improved as the unit progressed. Design technology became a vehicle for creative expression that is not usually associated with the teaching and learning of poetry.

Introduction

This unit was implemented in a fifth grade class and the teacher's goal was to teach the poetry unit while exposing the students to engineering design and the iterative process. This process required students to think about and visualize objects in three dimensions. Their success at doing this was dependent upon the detailed imagery presented by the students' original poems. Many of the same skills that are needed for three-dimensional visualization in engineering design are also useful in representing poetic imagery in three-dimensional form.

The middle school in which the unit was implemented is situated in an affluent suburb of a major northeastern city in the United States, where parent involvement and expectations run high. In the 2002-2003 school year, there were 4874 students enrolled in the school district, with 92.6% of the student population from a white background. The district had only 10 black (not Hispanic) students, 70 Hispanic students, and 5.8% of the students were of

Janice Koch (Janice.Koch@hofstra.edu) is Professor of Science Education and Director of the IDEAS Institute of the School of Education and Allied Human Services, Hofstra University, Hempstead, NY. Brooke Feingold was a graduate student in education at Hofstra University when this was written and is now a public school educator.

Asian, American Indian, Alaskan, or Pacific Islander descent, reflecting a lack of diversity when compared to other districts in the state (NYSED, 2003a). In this particular school, only 5.2% of the students were of Asian, American Indian, Alaskan or Pacific Islander descent, 0.8% were Hispanic, and 0% were Black (not Hispanic).

Planning a poetry unit required a block of time spanning two months in order to teach the unit and collect data on the students' experiences combining learning poetry with design technology. Upon completion of the unit, the students were to:

- Understand that poems are used to express emotion and feelings, and to tell stories;
- Understand that poetry may take different forms, such as haiku, clerihew, and an acrostic poem;
- Write descriptive poetry that created descriptive images for the audience;
- Understand that a metaphor is a literary device that creates a relationship by making a comparison between two disparate ideas;
- Understand that a simile is a literary device that is a comparison between two different ideas or concepts using the word "like" or "as";
- Understand that the design process is an iterative process which could serve as a metaphor for poetry as students create and refine their concepts and constructions by testing the poem and the design product as they are being created.
 - Is the poem creating the image I am hoping for?
 - Is the design meeting the specifications and constraints of the challenge?

Teachers have used design technology to help students more fully develop concepts in a variety of subject areas, including mathematics, science, language arts, and social studies. Migdol and Chapman (2001) write about how design projects often lead to missed experiences in the classroom. Instead of fostering critical thinking and strengthening students' inquiry skills, the project becomes the ultimate goal, instead of the learning (p.14). The authors devised a design technology guide to help teachers and students become better problem solvers and more critical thinkers. The technology guide has headings that include brainstorm; plan, design and construct, and reflect; with each having their own subset of questions. Students are expected to ask themselves questions about their choices, and the authors found that when students used this model it helped them to organize their thoughts, justify their decisions, and strengthen their writing skills.

Combining a design project activity with the creative undertaking of writing a poem allows students two venues to express their original ideas. Benefits of poetry may be compared to benefits of engaging in design technology. Routman (1990) offered some benefits of poetry that include:

- Builds immediate success;

- Sets a positive tone for the class;
- Teaches a powerful way to express a personal voice;
- Teaches importance of title, ending lines, and word choice;
- Taps into interest and knowledge;
- Frees kids up to write (p.30).

Design technology can be freeing as well. It can build success and set a positive tone for the class as students are busily engaged in building. It allows students another way in which to express their personal voice without the traditional confines of paper and pencil activities. Design projects also tap into their interests and prior knowledge. For students whose abilities in standard paper and pencil activities are not as strong, design technology allows them to shine. Research shows that differently abled students can take the lead as designers and builders (Koch & Burghardt, 2002).

The Problem

In a setting of high expectations for student achievement, the researcher hypothesized that integrating Design and Technology with poetry might improve student performance in poetry writing, while simultaneously providing a context in which to practice engineering design. Furthermore, the researcher wanted to know how students who were engaged in a poetry unit would experience fulfilling the requirements of a design project.

Methodology: Teacher Research

The field of classroom research, also called action research or teacher research, is a tool for understanding the conditions of learning in the classroom. Classroom research provides insights into *how* students learn by encouraging teachers to use their classrooms as laboratories for the study of learning (Mills, 2000; Sagor, 2000; Burnaford et al, 2001; Johnson, 2005). Techniques for the assessment of student learning are an integral part of classroom research. The researcher had the opportunity to observe student interactions and experiences through an unbiased lens as a result of being a visiting teacher to the class. The following methods for data collection included:

- Analyzing the responses to pre- and post unit assessment instruments;
- Maintaining a teaching journal
- Using frequent minute papers, in which students were asked a question about the unit and given a minute to respond in writing.
- Analysis of student understanding of poetry
- Analysis of student design portfolios and products
- Student self and peer evaluations

Students were provided with a series of poetry assignments. Each assignment was an opportunity for the students to apply what they knew regarding a different type of poem. In order to improve their ability to use

imagery in these poems, the students were required to represent their poetic imagery in graphical forms developed through an iterative, engineering design process.

The teacher as researcher was interested in understanding how students who were engaged in a poetry unit would experience fulfilling the requirements of a design project. The problem statement for the design challenge presented to the students read as follows: "Design and construct a three-dimensional representation of a classmate's poem." The specifications indicated that the students had to "Represent at least one image from the poem and that their design had to fit into a plastic storage box with the dimensions 12 x 6 x 4½ inches." The constraints were that the students "could only use class time and materials provided in class." Since the actual construction of the project was related to a specific form of poetry writing, the first part of the design challenge engaged students in creating a poem that had to include at least one concrete image, a simile or a metaphor, had to be between 10-15 lines in length, have a title, and could not be an acrostic poem. The reasoning behind disallowing the use of acrostic poems was that the researcher wanted the students to use other forms of poetry which would allow them to be more creative. Also, the poems were given to each other anonymously, so if a student used his own name for the acrostic poem, then he or she would be identified to a classmate.

This study describes the experiences of twenty-two fifth graders as they made sense of poetry writing in different formats and engaged in a design challenge related to their original poetry. The students represented heterogeneous abilities and functioned as an intact class. The researcher was a visiting teacher to this class. The class had no prior experience with design technology. Because photographs of the projects and some of the students were part of this study, permissions were secured in advance.

Findings

Students were asked to complete two design portfolios before they began constructing their projects. The "poem portfolio" served as a guide to help students with the planning and writing of their poems. The teacher wanted the students to brainstorm and reflect upon the specifications of the project before writing their poems. Students were given a design portfolio to help them understand how to analyze their classmates' poems from which they were building a concrete structure. The design portfolio also helped the students to plan the construction of the design. Students made connections between designing an artifact and analyzing the poem, and all students were able to create a concrete three dimensional structure from an abstract idea. The students had a plethora of materials at their disposal, and they were allowed to bring materials from home if they justified the need. Materials included various sizes and types of cardboard, Styrofoam®, plastic containers, cardboard boxes, fabric, pipe cleaners, scissors, hot glue, paper glue, tape, and paper towel and toilet tissue rolls.

Before students began the construction of their image, they were asked to obtain approval from the teacher as indicated by a signature on their design portfolios. This was to ensure that the students had taken the time to carefully plan their designs and select materials. They were also asked to sketch two different examples of the images they were going to create. These images were part of their portfolios.

Pre- and Post Assessment Instruments

In order to assess students' understanding of poetry as a literary form, an assessment instrument was administered prior to teaching the unit. A Likert-type scale was used for the first seven items with the scale consisting of: 1=Totally Disagree 2=Slightly Disagree 3=Undecided 4=Slightly Agree 5=Totally Agree. These items are listed below:

1. I like writing poetry.
2. I feel comfortable writing poetry.
3. I have had a good experience writing poetry in the past.
4. Thinking of ideas to write poetry about is difficult.
5. Learning poetry can help me improve in other subjects in school.
6. Poetry must rhyme.
7. All poems have to be about nature.

With items 8-14, listed below, students were asked to supply short written answers.

8. When I think about poetry, I think of..
9. What is your favorite subject?
10. What is your favorite type of poetry?
11. Write about an experience you have had writing poetry.
12. If you were to define poetry, what would you say it is?
13. Can you name a poet? If you can write it here.
14. List some examples of different types of poetry you may know of.

Item 15 asked the students to write a poem. Once they were finished, they were asked to circle the descriptive words that they used and to underline the two rhyming sentences that were part of the specifications:

15. Write a poem about the experience of eating pizza to someone who has never had it before. The poem should have at least six lines, three descriptive words, and two rhyming sentences.

Finally, the students were asked to read five sentences and indicate whether they included a metaphor or a simile:

16. Juliet is the sun.
17. Her brain is like a marshmallow.
18. That guy is a motor-mouth.
19. I am as content as a hen on her nest.
20. River races round its bend like a pack of black cats.

The instruments indicated the identity of the students, however, they were not used as a formal assessment tool and hence, they were answered without anxiety or fear of reprisals. Since the same instrument was repeated after the completion of the unit, the final scores indicate what, if any, gains in comprehension and attitudes were made through this integrated unit. The scores on the post assessment instrument improved greatly compared to the pre-assessment ($n = 22$). The average score on the pre-assessment instrument was 71.9%, and the mode was 80. On the post assessment instrument, the average was 91.7% and the mode was 100, revealing that many students had perfect scores on the final assessment of the poetry. This represents a significant increase in student understanding of poetry.

Seventy-two percent of the students could not name a poet on the pre-assessment instrument and of the 27% who did, 18% wrote Shakespeare. The other three answers were Shel Silverstein, Theodore Roosevelt, and one student named herself. This latter student excelled in the unit due to her own sense of herself as a poet already! On the post assessment instrument, 27% of the students could *not* name a poet. The most popular answers were Jack Prelutsky and Joyce Kilmer, with 13% of the students naming those poets. None of the students who answered the question on the pre-assessment instrument gave the same answer on the post assessment instrument.

Another question asked the students if they liked poetry based on a Likert scale of one through five (with five being 'strongly agree'). On the pre-assessment instrument, 9% scored either a one or a two, 50% scored a three, 18% scored a four, and 13% scored a five. On the post assessment instrument, 4% scored either a one or two, 18% scored a three, 45% scored a four, and 27% scored a five. From the pre to the post assessment instrument, students went from being undecided about liking poetry to either slightly agreeing or strongly agreeing.

The pre and post assessment instruments asked students if they felt comfortable writing poetry, which was also scored on a Likert scale. On the pre assessment instrument, 4% of the students scored a one, 12% a two, 31% a three, 29% a four, and 18% a five. On the post assessment instrument, no students scored a one, 4% scored a two, 18% scored either a three or a four, and 59% scored a five. Students felt more comfortable writing poetry after the completion of the unit than they did at the beginning of the unit.

Students were asked to define poetry on both the pre and post assessment instruments. Sixteen percent of the students on the pre-assessment did not have an answer. Another 16% said that it had to do with feelings. All of the answers were positive. On the post assessment, only 4% of the students said that they could not define poetry. Twenty-five percent said it is "about expressing feelings." The remaining responses were varied (See Table 1).

Table 1
Definitions of Poetry

Definitions	<i>n</i>
It is about expressing feelings	5
Stories	4
It is words that do and don't have to rhyme.	3
A creative way to write	1
Words make up beautiful lines	1
A type of writing	1
Words that fit	1
It is about anything you want it to be.	1
I can't explain it.	1
A peaceful way of writing	1
Words that tell about things	1
Soothing, fun projects	1

On the pre-and post assessment, students answered the question, "List some examples of different types of poetry you may know of." On the pre assessment, eight students had no answer, six students had one answer, and five students had two answers. Three students had answers which were not types of poetry, but topics in poetry. These answers included: weather, family, feeling, blue whales, lightning, funny, romantic, loving, and fun. The examples of types of poetry the students gave were: rhyming, acrostic, Japanese, nature, spoken word, and non-rhyming. On the post assessment, the results were related to types of poetry and illustrated in Table 2.

Table 2
Responses to Types of Poetry

Type	<i>n</i>
Acrostic	11
Cinquain	8
Clerihew	2
Couplet	14
Diamante	2
Found	1
Free Verse	5
Haiku	8
Limericks	15
Quatrain	16
Rhyming	3
Shape	3

To the question “When I think about poetry I think of...” 37% of the students mentioned rhyming in their answer, while on the post assessment, only 16% mentioned rhyming, with other responses including “feelings,” and other personal reflections, indicating that their thinking about poetry was more refined. A decrease in the “rhyming” responses was desired because the students’ initial understanding of poetry was that it *had* to rhyme and by the end of the unit, they were able to understand forms of poems that do not have rhyming components.

The researcher was interested in comparing their attitudes toward poetry and evaluated their pre- and post assessment responses to the question, “I feel comfortable writing poetry...” and “I like poetry.” Clearly, the dramatic increase in the number of students who felt comfortable with and liked writing poetry revealed an important success for this unit (see Figure 1).

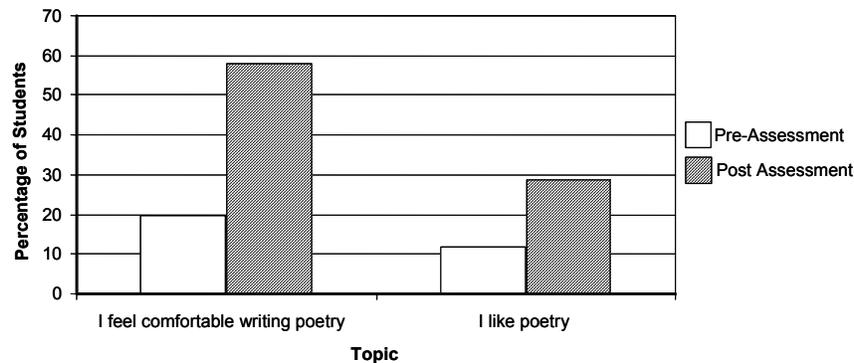


Figure 1. Students who scored a “5” in response to feelings about poetry.

Analysis of Teacher Journal

Throughout this unit, the teacher as researcher maintained copious notes recording the interactions involved in implementing the unit. As a result of analyzing this narrative data, the researcher identified three emergent themes. First, the students became more comfortable with sharing their poems orally and participating in class discussion about them. Secondly, the poetry unit gained life and excitement as the design project was introduced. Finally, the students gained expertise in manipulating the materials they needed to make the model from their drawings in their design portfolios. Clearly, the use of the portfolio was found to be an important tool for design.

Analysis of Minute Papers

At the end of various class sessions the teacher would have the students respond to prompts about their class work anonymously. These “minute papers”

were a quick and informal way for the students to provide insight into what they were thinking, feeling, and learning about poetry without the pressure of censure. The final minute paper given on the last day of the unit asked the students, "How did the construction of your design project enhance your learning of poetry?" Twenty four students responded. Seventy-one percent indicated that it did improve their understanding of poetry. Their explanations varied. One student wrote, "It did because you not only get to picture your image you get to see the image and look at the details." An insightful response was, "It enhanced my learning of poetry because now I know that poetry doesn't have to just be in poem form, it can be in project form."

Students were also asked to respond to the prompt, "From this experience I learned..." in minute paper form. One student stated the essence of the entire unit by writing, "I learned that poetry and poems can be three dimensional." Another statement that showed that the student responding understood the importance of planning in design was, "It is easier to first think and then work, then [to] work and [then] fix." The researcher could tell that this student had difficulties tackling the design process because he wrote, "Building is a long and hard process." However, another student overcame the obstacles in her design because she wrote, "You can make anything if you just try to make it."

Analysis of Peer Evaluations

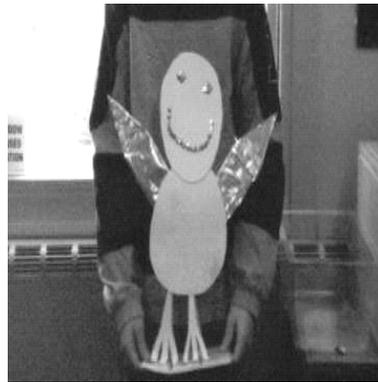
There were many different types of concrete interpretations of the students' poetry. Most students put a lot of effort into their work, which was revealed in the peer evaluations that indicated how accurately the finished projects depicted the images represented in the poem. Student peer evaluations also pointed out those projects that did not accurately reflect the designer's effort or accuracy of poetic interpretation. For example, one student had written a poem about the beach, and her peer had decided to build a sand castle, which is one of the images in the poem (see photo below). When evaluated, the designer was given a four out of a scale of five for how well she represented the poem because, "She did make a sand castle but there were also many other images to focus on." However, she was assigned a five for effort because, "She put a lot of effort in and tried her best to make it look good." Another student created a tree out of cardboard tubing and pipe cleaners as the image he was depicting from a poem about summer and swaying trees. His peer, who evaluated his work, commented, "I could not tell that it was a tree or that it went with this poem" and "I can't tell that he did a lot of work, but it looks simple and effortless." Another student depicted the image of her dog from a poem titled, "I loved Teddy". The designer took great pains to create the dog sitting on a cappuccino colored couch which is described in the poem. The evaluator gave this student a five for effort, because, "she put every minute you possibly could have into this project." There was also a poem written about a dog titled, "The Cutest Doggy." The evaluator gave the designer a five for effort because "the dog looked great and there was a lot of detail in it." However, the evaluator gave the designer a four in the category of how well the designer represented the poem because

“The designer made the dog smiling and wagging her tail, but [she] didn’t include anything that the dog was doing [as described in the poem].” I often found myself agreeing with the peer evaluators. The overall trend in the peer evaluations revealed that the students were able to be honest and critical while adhering to design specifications and constraints.



Waves rise up and then crash down
 People laying in the sand
 As children play and make sand castles
 Beautiful sunsets
 As the seagulls fly by
 Tan, brown, and peach colored shells
 Wonderful sea creatures like jellyfish and crabs
 The waves are as blue as the sky
 The sun beams down
 So people get a tan
 Beautiful things
 and beautiful land

Figure 2. Completed design challenge project and poem “The Beach



Soaring Eagle
 in the sky
 the U.S. label
 a predator
 soaring
 above all
 the king
 of the land
 the top
 of the chain
 it's wings
 a sword
 piercing
 the sky
 soaring eagle.

Figure 3. Completed design challenge project and poem “Soaring Eagle”

Parallels between Design Technology and Writing Poetry

As the students worked on constructing their design projects, the teacher as researcher was struck by the similarity of processes required for planning and creating an artifact such as this one, and planning and creating a poem. Both processes are iterative - that is, they begin with a plan that builds upon itself as it unfolds. The nature of poetry writing, like the nature of the design process, is also recursive as the designer goes back to re-do a design and the poet re-works an idea or an image by returning to lines in the poem that do not seem to work. As indicated by excerpts from the minute papers, students were challenged by writing the poems *and* creating the artifacts.

It became apparent that many of these students are accustomed to following explicit directions and are very good at it. However, when the directions include a challenge to be open-ended in their thinking and their designing, they become insecure and a bit unsure of themselves.

Conclusions

Based on the percentage of students improving from the pre assessment to the post assessment, it is plausible that the unit on poetry improved student achievement. However, based on the findings in the last Minute Paper, it would appear that the combination of both the design project and the poetry instruction allowed students to feel more comfortable expressing detail in their imagery and representing it through design and construction. Further, students with learning difficulties excelled when planning and constructing their designs. Their inclusion in this process was easier for them than the actual poetry writing. Hence, the use of design and construction allowed them to be more engaged. In addition, students who were not easily inclined to write and did not like the poetry unit became more invested in the unit through the design project. Through this classroom research, the discovery was made by the teacher as researcher that children's own ideas and opinions were validated through the dual creative processes of design and poetry writing.

Implications for Future Use of Design Technology

This study lends support to the idea that integrating design technology and language arts may be a way to improve student achievement. It provides some evidence that design technology can play a role in improving students' academic achievement. In another study, a researcher noted "we observed that student involvement in engineering design units led to their learning valuable and transferable problem solving skills as well as deep acquisition of [science] concepts" (Yocom de Romero, Slater, & DeCristofano, 2006). The importance of design technology for this poetry unit cannot be underestimated.

The researcher recommends that a control group be used in similar studies in the future study. The control group would receive only the poetry instruction and not the design instruction. This would allow a comparison between a traditional approach to poetry instruction and the curriculum integration approach.

References

- Burnaford, G., Fischer, J. & Hobson, D. (2001). *Teachers doing research: The power of action through inquiry*. Mahwah, NJ: Lawrence Erlbaum Assoc.
- Johnson, A. (2005). *A short guide to action research*. Boston, MA: Pearson Allyn and Bacon.
- Koch, J. & Burghardt, D.(2002). Design technology in the elementary school - A study of teacher action research. *Journal of Technology Education* 13(2), 21-33.

- Migdol, D. & Chapman, K. (Jan/Feb. 2001). It's not just the project. *Ties Magazine*, 13(4), 14-18.
- Mills, G. (2000). *Action research: A guide for the teacher researcher*. Upper Saddle River, NJ: Merrill Prentice Hall.
- Routman, R. (August, 1990). Everyone succeeds with poetry writing. *Instructor*, 111, 26-31.
- Sagor, R. (2000). *Guiding school improvement with action research*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Yocom de Romero, N., Slater, P. & DeCristofano, C. (2006). Design challenges are ELL-Ementary. *Science and Children*, 43(4), 34-37.