



# Story and Creative Writing as Pedagogical Practices in a Mathematics Classroom for Pre-service Teachers

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## INTRODUCTION

*[I]n real life we encounter problems and situations, gather data from all of our resources, and generate solutions. The fragmented school day does not reflect this reality.* (Jacobs, 1989, p. 1)

In a busy, self-contained, elementary classroom, where time is precious, cross-curricular integration is particularly important. The need to integrate the core curriculum in language arts, mathematics, science, and social studies becomes critical in times when literacy programs take up a significant amount of time in the school day. Incorporating writing and literature in a mathematics classroom is the subject of this section as we illustrate how a group of pre-service teachers used multicultural literature, and in particular folktales, to compose endings to stories incorporating

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mathematical concepts and problems. Critical reasoning skills were used as they made logical connections and developed strategies to problem solve endings to stories from different cultures. The author begins with the need for an integrated curriculum, discusses how mathematics and writing are integrated, illustrates samples of student work, analyzes the discussions of the pre-service teachers, and finally draws conclusions for this chapter.

### NEED FOR AN INTEGRATED CURRICULUM

There are several reasons why there exists a pressing need for pre-service teachers to experience an integrated curriculum. First, there has been a tremendous growth of knowledge in recent years. Second, school schedules have become fragmented, affecting the relevance of the curriculum for the lives of students (Jacobs, 1989). Every so often in both mathematics and language arts there are new national or state laws mandating the inclusion of newer knowledge in the curriculum and, therefore, students must meet the challenges of being responsible for even greater and greater amounts of information. This information must be integrated within a schoolday where the length of time has remained the same for many years. The fragmented school schedules, even in elementary school, partition one discipline from another as students learn in 40- or 50-minute time blocks. Donald Graves (1983) called the chopped-up curriculum the “cha-cha-cha” curriculum. Just when students get interested and involved in one project, the schedule demands that they move to another subject.

Students often find mathematics and writing difficult when used in isolation from their application. “Only in school do we have 43 minutes of math and 43 minutes of English” (Jacobs, 1989). Outside of school, problems occur within a milieu of many disciplines and within a flow of time not constricted into 40-minute blocks. Outside of school, students must make connections between disciplines for real-life and real-time experiences and use higher order thinking skills to solve problems. Further, the interdisciplinary approach to teaching is endorsed by subject-area professional organizations (Post et al., 1996).

### PRE-SERVICE TEACHERS

The teacher preparation at this campus was a fifth-year program. Students have earned their baccalaureate degrees already upon entering the teacher preparation program. Many of the students were commuter students and were the first in their families to go to college.

Further, they represented various ethnic backgrounds, languages, college majors, and ages. Most of the students were women and most also had jobs while earning their teaching credentials.

For this particular study, two of the same elementary mathematics methodology courses were scheduled at the same time. During the first meeting, both classes were met by the professors in a large room. The pre-service teachers were then informed of a specific activity in which half of them would participate. In order to remain fair, all names were written on a piece of paper and put in a brown paper bag. The two professors took turns in drawing names until half of the names got called. This process would give the pre-service teachers an opportunity to work with non-classmates. The last pieces of information given to the pre-service teachers before they were asked to go back to their own classes were the date and time of when the activity would happen.

### INTEGRATING MATHEMATICS AND WRITING

When pre-service teachers enrolled in the elementary mathematics methods course at Cal State LA, the last thing they expected was that the writing would be incorporated into the coursework. The author believed that this course was a vehicle for bringing the issue of an interdisciplinary approach to teaching to the attention of pre-service teachers. Integrating the teaching of mathematics and writing seemed to be particularly challenging for beginning teachers. Also, about 71% of the post-baccalaureate students in teacher education programs conveyed being very comfortable with general writing compared to about 24% with academic writing (Abbate-Vaughn, 2007). Together with this claim was the realization that colleges of education and teacher education programs needed to increase academic writing skills of their students for the simple reason that they were responsible in the preparation of teachers that would teach many school subjects including, of course, writing (Plakhotnik & Rocco, 2016).

Additionally, the courses were conducted via a course management system; the instructor was teaching primarily the course online. This scenario gave the author another opportunity to illustrate to pre-service teachers how to make use of multiple resources and disciplines while teaching mathematics. When the day of the activity arrived, everyone in this group was asked to go online and to login synchronously.

The newly formed class was divided into four groups and each group was given an unfinished multicultural story to read. These stories were

based on folktales from around the world (Shannon, 1991) and involved a mystery or problem to be solved by the characters. Stories that were chosen for the pre-service teachers to work on not only allowed their originality and creativity to shine but also provided an occasion to demonstrate their understanding of mathematics (Halpern & Halpern, 2005). The task for the pre-service teachers was to creatively end the story with a mathematics problem-solving activity and to develop a bulletin board that would reflect both this folktale and the intended mathematics topic. The instructor assigned each group to a “chat room” where the members of each group might have an online discussion on how to end the story. By doing so, it gave pre-service teachers a nonthreatening environment where they could express their thoughts and contribute their ideas freely.

Otherwise, this might not have occurred in a real-time classroom. Often at this urban university the students were strangers who entered classes, and because of shyness, anxiety of speaking in public, or fear of not giving the right input, they did not offer their personal opinions. However, this online course management system enabled students to work in small groups by *writing* their ideas rather than *speaking* them. Also, this system permitted those less verbal students to offer ideas through written language.

After forming their ideas on how to end the story, the students then selected a member to post their work on the course management system bulletin board. This electronic bulletin board allowed students to readily obtain, at their convenience and request, messages or files that were available to them. The following are examples of the kinds of endings by the pre-service teachers, which were written collaboratively online, and the teaching methods they developed to integrate mathematics, writing, and multicultural literature.

### SAMPLE ENDINGS TO STORIES

One of the stories that was presented to the pre-service teachers was from a Korean anthology.

Once upon a time, there were three children with their grandmother. The children all decided to build the biggest snowman the village had ever seen. The three children each began rolling their snowballs. They continued to roll and roll and the snowballs got bigger and bigger. When each ball got too big for one to push, two pushed, then all three together. When they could not move the biggest of the three balls anymore, they stopped.

The children tried to lift and stack the second ball on top of the first, but they could not.

They had done such a remarkable job of making them so big that they were too heavy to lift. They were beginning to scrape the snowballs down to make them smaller when their grandmother came out of the kitchen to check on the children.

They explained their problem to their grandmother. After looking into the situation, the grandmother said, “Hmmm, I see the problem now. Why ....”

One group of pre-service teachers discussed and wrote the following ending to this story.

[I]t looks like we are going to have to make these snowballs a bit lighter so we can lift them. If they all weigh 20 pounds to begin with and we want them to each be light enough to lift, we are going to have to scrape some snow off of them.

Let’s leave one snowball on the ground and not scrape anything off of it. The middle snowball needs to be 5 pounds lighter than the bottom one. The top snowball needs to be 5 pounds lighter than the middle one.

The grandmother asked the children how much snow they were going to have to scrape off the snowballs all together to make them light enough to lift. What would the weight of the bottom snowball be? What would the weights of the middle and top snowball be?

The next step for them was to develop a bulletin board that could be used to teach a particular mathematical concept. The students in this group created a bulletin board that was linked to learning centers and focused it on problem-solving:

The bulletin board would contain a picture of three children, and the three big snowballs. Then the next consecutive picture would have them scraping snow away and measuring it. Then the last picture might have them with the Snowman they had built and the village people around cheering since theirs was the largest snowman ever built. The bulletin board would also contain some addition and subtraction equations. For example:  $20 - 5 = \square$  and  $\square - m = 15$ .

Their ending used critical thinking and problem-solving skills, which included ending the story creatively. They also adapted the ending to the particular subject matter that they were studying, which in this case was

mathematics. This group of pre-service teachers developed a bulletin board that focused on addition and subtraction equations, which basically highlighted the process of composition and decomposition of numbers. Showing that addition and subtraction were inverse operations was also demonstrated. Notice that this group had written equations on their bulletin board:  $20 - 5 = \blacksquare$  and  $\blacksquare - 5 = 15$ . These equations depicted the early concepts of the unknown or, more formally, the *variable*. This gave an early introduction of algebraic thinking in the elementary grades, particularly with equations.

Not only were they thinking mathematically, but also they were using strategies drawn from their expertise in writing. Pre-service teachers were given opportunities to write in different genres by following the form of the specific fable that was used. In doing so, they had to read the text to discover who the characters were and how they acted and spoke. They learned how to use dialogue in the precise way that was used in the beginning of the story. In order to continue the story and write an ending, pre-service teachers had to develop a style of writing that would correspond to the beginning. They also realized that the vocabulary of mathematical writing differs from that of historical writing or scientific writing. Teachers used the words of mathematicians such as “measuring” and “equations.” Additionally, these pre-service teachers were able to work collaboratively in small groups, thus realizing the potential of using a variety of resources when writing. Because reading and writing are inherently social processes, students realized how much easier writing could be when done with others (Dyson, 1989).

Another group of pre-service teachers came up with this ending to the same story. When the grandmother said, “Hmmm, I see the problem now. Why ...”

can't you three kids pick up the snowball? Because it is too heavy. So, how do we solve it? If 3 kids cannot pick up the snowball, and we want to make the biggest snowman ever, don't make the snowball smaller! Get more kids to help lift!

They then created a bulletin board to teach multiplication. The following describes their bulletin board.

Our bulletin board will have flannel backing, showing a white flannel snowball with a “50 lbs.” on it, equaling 5 figures of children with the number “10” on them. (This symbolizes that each child can lift 10 lbs.)

five kids times 10 pounds each = fifty pounds Or in symbols,  $5 \times 10 = 50$ . We will also have a 2-pan scale to visually depict 50 base-ten units equaling 5 bags of 10 base-ten units in each. The students can play with these units, seeing that indeed, 50 units = 5 bags (of 10 units each).

This group focused on the concept of multiplication for their selected ending to the folktale. They also included some modeling of the number 50 by representing it with concrete models. Also, this group made use of the meaning of the equal sign as “balance” or “is the same as.” The future elementary school students of this group would get the benefit of being able to use a multicultural folktale and weave in writing and mathematics. Although this group developed a different ending to the same story, they used the same processes of mathematics and writing. Not only were mathematical concepts involved in this ending to the story but also the pre-service teachers widened their thinking about the problem and included principles from physics. In doing so they illustrated the kinds of higher order thinking that was possible when students were encouraged to integrate different disciplines.

Another story that was presented to the pre-service teachers came from Chile and involved a young ruler and a maiden named Carmelita:

In Chile, there once lived a young ruler who thought cleverness was the most important thing of all. He was forever outwitting his advisers and often played jokes on others by asking them the riddles that were impossibly difficult to answer. When it came time for him to marry, the young man said that he would not marry anyone who was not as clever as he was. And so, everywhere he went, the young ruler asked the same riddle: “If you care for a basil plant tenderly, how many leaves will it grow?” In village after village, the young women ran away, embarrassed at not knowing the answer. That is, until he asked Carmelita. She looked into his eyes and said, “I will tell you, but only after you tell me how many fish now swim in the sea?” This time it was the young ruler who had no answer and left embarrassed. But he was also impressed. The next week, when Carmelita outwitted him again, he decided she was clever enough to be his wife. Carmelita agreed to marry him, but only if she could be granted a last request. The ruler was puzzled about her request and

One group ended the story this way:

pondered and pondered with it. He eventually agreed to it. He said, “So, you want me to divide my 100 acres of land in the way you decide. How do

you want them divided?” Carmelita replied, “Please keep  $\frac{1}{2}$  of your land to yourself. Then,  $\frac{1}{4}$  of the original size of the land, you will give equal amounts of land to 50 village families,  $\frac{1}{8}$  will go to a public school, and  $\frac{1}{8}$  will go to the village as a park.” The ruler was so touched with her kindness and said, “Carmelita, you indeed are a wise woman and we shall live happily forever.”

The group decided to design their bulletin board for this story in this manner:

The bulletin board will have a background of the countryside, with a castle in one corner. Next to the castle are cutouts of the ruler and Carmelita. At the top of the boards, it will say, “A Last Request ....” To the right of the castle, it will say “Carmelita agrees to marry the clever ruler, but only if he grants her a last request: to divide his own 100 acres of land in the way she decides” in smaller letters.

Finally, in the middle of the board it will pose this question, “Interpret Carmelita’s request for the ruler.”

The bulletin board would then show the criteria Carmelita had on how to divide the ruler’s land. At the bottom of the board, this question will be stated: Carmelita already knows the ruler is clever. What else is she trying to find out about the ruler through her last request?

This group used this story to illustrate the concept of multiplying fractions. To teach this, the group included a learning aid—a grid of 100 squares. The grid would be used as the visual representation of 100 acres of land. Using this grid will help the students see how division of the land works. These pre-service teachers successfully showed complementing symbolic manipulation with a visual representation of how to solve a problem.

This special ending was another example of how this activity could give students opportunities for higher order thinking that include application, analysis, synthesis, and evaluation. Their intent here was to introduce and to develop the concept of multiplication of fractions but because this concept was embedded within the context of a multicultural story and because this group had an interest in social issues, their ending widens the mathematical concepts to also include real-life problems of hunger and educating the poor. Issues of equity and social justice were critically important to our diverse population of pre-service teachers who liked the idea of



mathematics being used as a pathway to “level the playing field.” Different groups of pre-service teachers came up with various endings to the same story.

Carmelita’s request is for the young ruler to give some presents to each member of her family. All these presents would come from the ruler’s warehouse. All the presents in the warehouse must be given away. Now, if each person gets two presents, then three presents will be left; but if each person gets three presents, then the ruler will be short of two presents. The young ruler looked confused after listening to Carmelita’s request. Let’s help the young ruler solve his problem so the story can have a happy ending. To do that, we need to find out how many people are in the family of Carmelita? And, how many presents should be prepared?

The ending for this group used the mathematical concepts of solving simultaneous linear equations and applied it within the context of direct application to the real world. Their ending also considered the possibility of using other strategies in solving this problem instead of using variable equations; an example of which is guess-and-check.

Here is another ending to the story:

The ruler was puzzled about her request and was determined to win her hand in marriage. Carmelita stated her request, “You will give me one rose every 12 hours and I will accept your proposal of marriage upon receiving my 62 roses.” The next day the young ruler gave Carmelita her first rose and continued until she received the 62 roses. The wedding was a beautiful event and they lived happily ever after. QUESTION: How many days did the young ruler had to plan the wedding?

This group was able to come up with a different twist to the ending. This ending was something quite familiar to all and had a more common scenario.

Another group ended the story as follows:

The ruler was puzzled about her request and agreed to abide by her wishes. Carmelita’s request for the ruler was to make the seating arrangements for their large reception for 1,000 guests. Carmelita insisted on using 2 sizes of tables only, one that seats 10 guests and the other seats 5. Using both table sizes, how many tables will the ruler need to seat his guests?

This group focused on concluding the story with an emphasis on open-ended problems. Students should possess a previous knowledge or exposure to the division process. Depending on who solved it, the number of 10-guest tables and the number of 5-guest tables would vary. The group even made sure that there was a hint to help solve the problem. By following the first hint and solving the problem, the answer was 200 tables all in all for the guests. The second hint suggested that there were other solutions possible, which led the students to use various combinations of 10-guest and 5-guest tables.

A final example of the work of the pre-service teachers follows:

The ruler was puzzled about her request, yet accepted her challenge. Carmelita told the ruler that if he were clever enough to solve the following problem, she would marry him. The problem was: If we invite 21, 30, or 42 people to our wedding, and we want to order equal number of taquitos with none left over, How many taquitos do we need to order?

This ending to the story was focused on Least Common Multiple (LCM). The objective was to find the number of *taquitos* (a Mexican food consisting of a small, thin, rolled-up flatbread made from finely ground corn and some type of savory filling and then crisp-fried) that will be shared among 21 or 30 or 42 guests so that there would be no left over (remainder).

Normally, one would be given routinely two numbers to solve for the LCM. Here was an opportunity for the students to look for the LCM of three numbers emphasizing real-world connections. A lesson similar to this could be truly exciting for the students. The inclusion and use of *taquitos* added to the multicultural flavor of the lesson as well!

## TRANSCRIPTS OF DIALOGUES

The ending to these stories and the bulletin boards was developed through online discussions. The course management system allowed an examination of some of the online language by recording the discussions. It was discovered that the challenges of delivering this activity through a course management system created a context in which students were learning about technology as they were learning about mathematics and writing instruction. For instance, four students were successful in logging onto the course management system and began talking about the problem but

were constantly interrupted by other students who were trying to log on or who were pushed out of the system. Just as one student wrote: "Do you want to first come up with the solution to the story, or do you want to work on the bulletin board first?" Another student logged on and wrote: "hi gals. sorry i am late ... tried really hard to get in."

During one period of the discussion, the students began to wonder whether or not the number 1000 was appropriate for the grade level: "I think 5th and 6th graders could work with 1000 if not higher. No?" Another member wrote: "I teach 6th grade and the numbers are still high. We are teaching concepts and don't want that to get muddled up in large numbers." Then one of the members wrote that she had a 6th grader sitting beside her who said that "100 is better." Another in the group redirected the detailed discussion of which number to use and focused the group back on the assignment. She wrote: "OK, lets move on from numbers we need to decide 100 or 1000 it doesn't matter, as long as we come up with a clever solution." An analysis of this discussion revealed that these students were actually finding that specific number that was most developmentally appropriate.

Upon the examination of the transcript of their online discussion, it was also recognized that a new kind of modified language was created among these pre-service teachers. Students in this course were using language in ways that were typically technological. In their discussions, they were not always concerned with correct spelling or punctuation (e.g., "[I] think we should come out with the answer first then design the bulletin board"). To do so would have meant that they could not quickly join the online discussion. They also learned to make their entries short and concise since lengthy replies would take longer and by the time they would be ready to send it, the group would be on to something new. Therefore, it seemed to us that these textual discussions were more like real speech than text. The transcript showed that if students could not navigate this textual terrain, they soon dropped out of the discussion. In one instance a student wrote: "Wait!" but soon after left the discussion room.

As the transcript was further reviewed, it became evident as to how students wanted the ending to be mathematical but at the same time "tricky and clever." They thought of the personalities of the characters in the story about Carmelita as they agreed that the solution not only had to "test his brains" but also "tie into his heart." As one group member wrote: "Is the guy a prince or a king?? so it can tie to his personality and also the way he rules his kingdom." At this point, one of the members

remembered another multicultural folktale called “The Empty Pot” and told that story. By bringing in past knowledge that might help them create a new ending to this story, members were using intertextuality to compare and contrast textual ideas.

### PRE-SERVICE TEACHERS’ REACTION

When this actual activity was done with the pre-service teachers, their skepticism about the inter-disciplinarity of mathematics quickly disappeared as they saw the functionality of mathematics. Their old schooling of memorizing procedures and formulas without understanding now had been replaced with a new vision of bringing life and context to lessons. They also realized how assessments should not be limited to Q&A but should be varied and ongoing. Lastly, the pre-service teachers needed little or no convincing that students need to take charge of their own learning. Fitting all students in a single way would just result to frustration, pointless struggle, and low self-esteem. They should be able to carve their own path, process, and procedure of learning.

### AN ACTUAL INTERDISCIPLINARY LESSON

Teaching mathematics, integrated with the teaching of writing, poses some challenges and hindrances for many teachers. Many teachers report that they simply have no idea how to integrate mathematics and writing while other teachers mention the inadequate time for this practice to happen. However, teachers can integrate mathematics not only with writing and literature but also with other subjects. In fact, this integration can combine problem-solving, storytelling, reasoning, critical thinking, cooperative grouping, and technology. Indeed, the teachers make use of multiple resources and disciplines. To demonstrate how this process is carried, the author focused on an urban first-grade class in the Los Angeles, California area. Most of the students were in free lunch or discounted lunch programs and many students spoke, aside from English, another language at home. They still were developing and growing as readers and spellers.

The authors chose a common Aesop fable entitled “A Drink for Crow” (Shannon, 1991).

Some students were familiar with the story and knew how the story ended. As these were first graders, the teacher needed to read the story to

the students. In order to capture their attention to the fullest, the teacher had to use some props so that the students could identify the main character and could get a clear image of the setting. However, due to lack of a toy crow, the teacher had to improvise and used a toy dog. So, the teacher began reading the story with some improvisations.

*Once there was a dog (crow) that had grown so thirsty that he could barely move. He jumped (flew) down to a big pitcher where he had gotten a drink the day before, but there was only a little bit of water remaining at the bottom. He tried and tried to reach it with his tongue (beak), but the pitcher was too deep and his tongue (beak) was too short. But just as he was about to give up.*

The teacher suddenly stopped reading to the surprise of the students. The students then were instructed to get back to their groups and to listen to further instructions about the forthcoming activity. Once back in their groups, the teacher said to the students that she wanted the group to discuss the story and to come up with an ending. However, this ending also had to have a mathematics problem involving the operation of addition in it. Additionally, they were told that in order to help in the writing of the ending to the story, they had to do a *quick-draw* of what the ending would be.

Each group of students brought out a sheet of paper and folded it into four parts. They were supposed to draw their ending to the story in a four-part sequence. Before letting them work, the teacher reminded them again to be creative and let their imagination work for them. As soon as the teacher finished giving instructions, the students immediately began working. Sample quick-draws and story endings are found below. Because these were first drafts, the students were allowed to use invented spelling (Fig. 13.1).

The story ending for this group is indicated below (Fig. 13.2):

*The dog cood not dringlk. One little gril had a cup that had water. She put the water in the pitcher. The dog drank the water and he shaked. the drops were weting the flor. There were 3 drops at the start and then anader 5 drops. How many drops of water in all?*

*[The dog could not drink. One little girl had a cup that had water. She put the water in the pitcher. The dog drank the water and he shook. The drops were wetting the floor. There were 3 drops at the start and then another 5 drops. How many drops of water in all?]*



Fig. 13.1 Quick-draw for Group #1

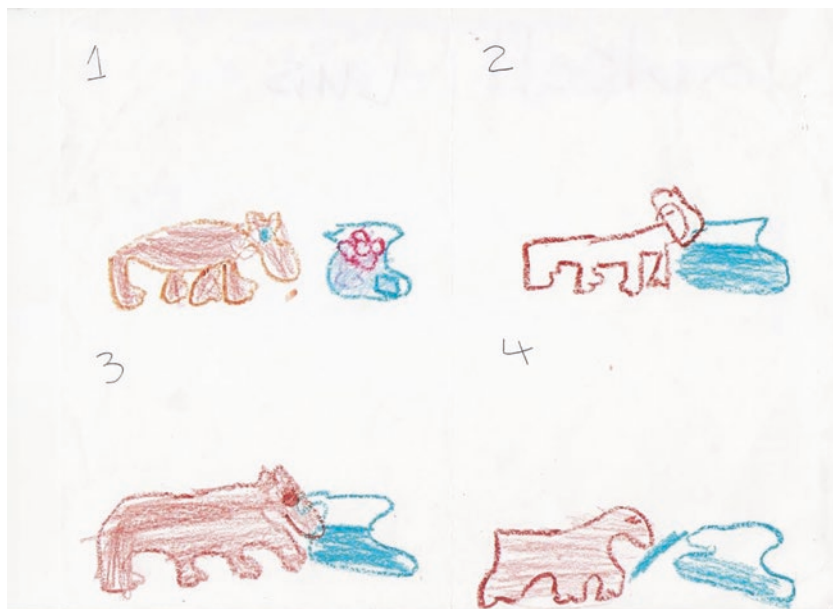
Another story ending for the second group is found below:

*First the dog sees the pitcher. then he walks to it. Then he pusheis it 5 tymes. He then pusheis it agen 2 tymes. Then he drinks it walle the water is falling down to the ground in his mouth. How many tymes did the dog push the picher so that the water falls down.*

*[First the dog sees the pitcher. Then he walks to it. Then he pushes it 5 times. He then pushes it again 2 times. Then he drinks it while the water is falling down to the ground in his mouth. How many times did the dog push the pitcher so that the water falls down?]*

From these two examples, one could see how an activity like this one may be adapted to all grade levels and to students of varying abilities, backgrounds, and interests.

When the students were working, this particular teacher immediately observed the high level of involvement and excitement they were demonstrating. The students were conferring and giving input to the story ending and the discussions among them involved an astonishing exchange of



**Fig. 13.2** Quick-draw for Group #2

ideas. Many Second Language and English Learners were involved in a safe, low-risk environment where everyone shared ideas and contributed to the activity.

Incorporating mathematics, art, literature, and writing into an activity clearly gives the students the training they needed regarding their regular writing skills and allowed them to use their creative energy. A bonus for this type of activity was that they also honed and polished their composition skills and used the writing process. When the activity was completed, the teacher asked them to showcase their work to each other. They hanged their work similar to a gallery. As the gallery walk ensued, children proudly displayed their ideas and drawings. They were seen by all students who at this specific age had very vivid imaginations. Students also were confident in their presentations and showed signs of being proud of their group work.

Having students integrate mathematics and writing meant that within a 60-minute block of time, students engaged in both mathematics and literacy. Students were given the task of creating a mathematics problem involving addition. The students experienced an atypical mathematics

activity, which was not in the textbook. Further, this did count as an alternative form of assessment and might be used to check for understanding. Ordinary paper-and-pencil worksheets were fine some of the time, but this additional activity for assessment would increase student interest.

In particular, this activity also involved an addition problem. However, it did not have to be restricted to one topic but may be substituted with another. For instance, the teacher might ask for a subtraction problem or even a geometry problem. Teachers might even ask the students to decide on their own what concept or topic in mathematics they want. Imagine what the students would do if they were asked to decide on their own! Truly the possibilities in this situation became endless!

As a reminder, the integration of writing with another discipline does not have to be exclusively in mathematics. The other areas of integration may be in science, social studies, physical education, or even music. In this story, a natural topic to connect in science is *volume displacement*. The crow wants the water level to reach the top of the pitcher, which may be achieved by putting pebbles in the pitcher. It surely is exciting to find out how teachers and students will integrate this story in other disciplines.

Finally, it provides an opportunity to use multicultural stories in the classroom. At this day and age of information technology and globalization, teachers need to assure that their students develop an appreciation for other cultures, languages, and ideas. As teachers use literature from other cultures, students experience the traditions of others and how they live.

### FURTHER RESEARCH

This activity integrates mathematics, creative writing, and literature. It has demonstrated the importance of connecting mathematics with other subjects like reading and writing. One suggestion for further research is to develop the connections among science, creative writing, and literature. It will be delightful to see how science concepts like electro-magnetic forces or chemical reactions are written creatively into a story ending.

Another area of research is to see how an approach like this one will play in a bilingual classroom. The activity presented here is geared toward a monolingual classroom. The author wonders if code switching between two languages will impact students' creative writing.



Lastly, another area of research will be on gender differences. Will connecting mathematics or science concepts with arts and/or humanities activities illustrate a greater preference among girls or boys or there is no difference at all? The potential for further research and study indeed is abundant.

## CONCLUSION

Reading and writing play an important role in the classroom. Not only do teachers instill in our students how to read, but they also ask them to read to learn. Teachers also expect students to use reading to learn about the world. However, most of the time students see reading and writing in isolation rather than in connection with other disciplines. Experts often recommend that an integrated approach will be the best way to combat this notion. Teachers need to show that reading and writing are present and are utilized in all subject areas. Using stories from other cultures is a useful strategy to use in the classroom with all subjects. Teachers will find this approach will continue to bring better opportunities and more ideas to their students and greater professional growth for the teacher.

The author has discussed using mathematics and writing together because these two disciplines are particularly suited for describing to pre-service teachers the importance of an integrated curriculum. Both disciplines lead students to think clearly and critically. Both also use tools and processes that can be easily maneuvered and manipulated, and both use terms such as *list, brainstorm, predict, estimate, chart, map, draw, sketch, summarize, pose questions, observe, and express opinions*. Using these two processes together allows pre-service teachers the opportunity to operate with higher order thinking skills and use those skills to read, talk, study, and create information to solve problems. In doing so they illustrate the kinds of higher order thinking that is possible when students are encouraged to integrate different disciplines. Simply put, writing and mathematics go together (Frank & Uy, 2004). It is through interdisciplinary approach that a real representation of the nature of knowledge is demonstrated (Post et al., 1996).

The author also wants to dispel the notion that mathematics and writing are disciplines that contains problems in which only teachers have the solutions. As mathematicians and writers, it is realized that these disciplines are basically creative processes in which there are no “right answers.”

The author aspires that for these pre-service teachers to understand how both disciplines are tools that people use in their everyday lives to solve problems in multiple ways. In developing an integrated curriculum involving multicultural literature, students have many diverse opportunities to use both the tools of mathematics and writing to solve problems in various ways.

Because the author feels that mathematics and writing are disciplines that include a particular kind of *language*, one needs to make sure that the development of these languages be addressed. Key words and terminology must be clearly identified so that students will communicate in these languages fluently. Like any language, mathematics is a vehicle *to explore the fantastic, the fictional, the conceivable but unreal* (Clader, 2016).

The author also wants to integrate mathematics and creative writing to show a way of incorporating other disciplines. By starting with these two disciplines, extending to a third or more disciplines will now be less complicated and more practical. A teacher who wishes to incorporate different disciplines shall examine the curriculum carefully and identify common themes or topics.

Finally, these pre-service teachers are now able to work collaboratively in small groups, which make them realize the importance of utilizing different resources when writing and/or doing mathematics. They also realize the value of doing work cooperatively. They also have the experience of incorporating a multicultural approach in teaching writing and mathematics. By using inter-disciplinarity of mathematics, the learning of mathematics by the students is not done in isolation but in a much needed, contextual, applicable, and real-world situation. Indeed, there is no better way of bringing learning to our students.

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