

Book Arts in Seventh Grade Math and Science

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Introduction

For the last four summers, I have taken workshops (1 to 3 days long) in Book Arts at the Chabot Space and Science Center. These workshops are directed towards educators, teaching book-making skills accessible to children and sharing ideas for ways to apply them with students. I fell in love with the craft and have shared what I learned with other teachers – and brought others to the workshops, as well. However, other than a cross-grade craft project with second and third grade, I had not yet made book arts a part of my seventh grade math and science curriculum. I was held back by the logistical challenges of teaching these skills to 24 students' varied interest levels, skill levels, and backgrounds and by the time constraints teachers feel as we make curriculum choices. Book arts continue to fascinate me and I decided that this year I needed to share this with my students.

Problem Statement and Research Question

My project this year is on integrating bookmaking into the seventh grade math/science curriculum. My research question is whether book arts is a useful and practical addition to seventh grade math and science at St. Paul's. The question has two parts. The first is whether creating books, the forms as well as the content, will add to student understanding, provide an alternative method of assessment for some topics, and appeal to different intelligences or learning styles. The second part of my question is whether it is feasible to create book structures with seventh graders given the parameters of class size and schedule. My rationale for adding book structures is that it's fun, creative, encourages students to process information actively rather than passively, allows for a combination of images and words in understanding and presentation, and helps the students make the material their own.

Methodology and Data Collection Overview

This year I included two book-making projects, one in math and one in science. Both were modifications of already existing projects. Two of my data sets are the assessment of this student work. I also documented my experience in and response to preparing for and working with the students to create the book structures themselves. Analysis of the logistical issues and the affect on my curriculum and teaching time is the third data set. In

addition, I did an informal survey on the use of student-made books in earlier grades to see if other teachers had incorporated book arts curriculum, especially outside language arts, to understand what experience my students might be bringing in to the projects and to build on the work of other educators.

The Book Arts Projects

The first project was a part of the unit on the cell. Students work with partners to create a model of a plant or animal cell. In the past, the model had also included a glossary explaining the role and function of the parts of the cell. This year each student worked individually to create a separate glossary, presenting the information as a book. The idea was to combine words and images and to make the book interactive for the reader. Rather than requiring a single book structure, I offered the students a choice. The options were a book created from envelopes, a concertina book with pockets, a concertina book with flaps, or a book folded from individual sheets with diagonal pockets.

I showed examples of each of the structures to the entire class and then taught the students the structures they chose in small groups. I brought each group into the break-out room where I had all the materials available and a table for a work space. The rest of the class worked independently in the classroom.

The second project was the math story. We begin by reading and discussing a number of stories that teach or include math concepts. Students then choose a topic, the age group for which it is appropriate, and teach the material through a combination of text and illustrations. This year I required that the students present the story as an actual book. Again I gave them a choice of structures. They could use the concertina structure they might have learned for the first project with or without flaps or pockets or could learn new structures. The new options were flag books, variations on tunnel books, and folded signatures punched and bound with a skewer or a ribbon or glued into a concertina spine. For those who wanted to go even further I also offered a concertina book in a box or sewn signatures. Once again, I taught the structures in small groups while the rest of the class worked independently.

Data Analysis and Conclusions

For the cell project, about half the students chose the envelope structure. One fourth of the class chose the concertina book, four creating pockets, and 7

creating flaps. Six students created the book with diagonal pockets. Six students made other types of books, some of which were preapproved, some of which were not. The quality of the final work was not related to the structure chosen. In each group there were students who did not follow the directions completely. The most common error was not to include illustrations or to decorate with images that were not related to the parts of the cell. In each group the majority of the glossaries were artistic, well researched, clearly written, and appropriately illustrated. Students also added creative twists like velco closures or additional decoration. Most students used the materials I provided, although a small number who did the assigned structures used or added their own materials. One student even created his own envelopes.

Overall the quality of the glossaries was excellent. I made two changes to the project this year, having the students work individually as well as having them make a book, so I don't know if all the improvement I saw was due to the books. The two changes together resulted in both better work and students demonstrating more complete knowledge. Combining text and images increased understanding. As the students created the pockets and the flaps and chose where to put the definitions and illustrations, their understanding increased further as they interacted more with their own work and made decisions. It is a more active, less passive experience for both the creator and the reader. I will definitely have the students create books for the glossaries next year. The structures I chose worked well and I will offer the same options again. Each student chose a structure that appealed. No students grumbled and seemed unhappy with the options. As I helped them create the structures, the mood was generally invested and excited.

The logistics worked well, too. It is important to have a good, clear activity where the rest of the students will work independently and stay focused when not in the break-out room, especially if there is no other adult in the room. That way you do not have to interrupt the small groups to redirect the larger class. Some students require more individual help creating the structures; others are able to follow a demonstration. By keeping the groups small enough, I was able to help those who needed it more and there was very little frustration. The main glitch was that I offered students choice about page size for the concertina structures and it was difficult to calculate and cut all the different papers needed. Next year I would probably offer three choices for size for that structure. I will figure out how each will work and have a prototype.

Next year I will rewrite the directions to make the requirements for the illustrations clearer. I will also be able to share some of the projects from this year. Demonstrating the solutions this year's class found will not only demonstrate possibilities, but also reemphasize the requirements. The

individual book with the illustrated glossary for the parts of a cell was a success and an improvement over what I had done previously and I will continue to include it as a part of the cell unit.

The math story has been a part of my curriculum for a number of years. This is the first year that I have required that the final project be in the form of a book. I have had students who have chosen to do so in the past, but most books have simply been stapled. For this project, the most popular structure was the folded signature, chosen by one third of the class and tied with everything from ribbon to embroidery floss to a chain. Eight more students chose to take on the challenge of sewn signatures. Nine students made bound concertina structures, some binding it into a book cover, others letting it open out like an accordion. Two students made a book in a box and two put pages in a concertina spine. Six students created their own books by binding single pages in a variety of ways and three students did not manage to put their loose pages into a book.

In this project I again provided all materials and taught the chosen structures in small groups. More students this time chose to learn the prototype and then either embellish or create another version using their own materials.

Adding the book structure requirement to the math story project does not seem to have affected the topics students chose to teach; there was a range from counting stories to fractions to area of quadrilaterals. All of the stories used a combination of text and illustration as required. Overall, however, the stories were stronger with a more finished feeling than in previous years. Creating the book encouraged the students towards a more fully developed project.

There were two difficulties. Some students had already written and illustrated the rough drafts of their stories on the computer and the structures were not designed to support full size pages. They had to figure out a way to reformat the pages or adapt the structures. Other students adapted or wrote their stories to fit the structures, feeling the need to add or take out an episode to fit the number of pages. The structures sometimes constrained the stories. Next year I will need to think again about which structures to demonstrate for this project. I will also make sure to introduce the different structures early on and discuss possible page sizes and page numbers for each.

Overall Conclusions and Thoughts for the Future

In the lower school, teachers have incorporated some book arts into the curriculum with projects like creating word books or writing biographies. Depending on the age of the child, all or part of the structure may be pre-made. Over the years, students have sometimes created books in art class, too. More teachers are moving in this direction. Next year, sixth grade is going to create a book to record their hopes and dreams at the beginning of the year. There are no other projects at St. Paul's where students create book structures for math and science projects, although teachers will sometimes combine activity and lab sheets together into a booklet. As students in the lower grades reach seventh grade, I will benefit from the knowledge of book structures they bring with them.

I will definitely include both the book projects I piloted this year again. The cell glossary works well as it stands with the addition of more explicit directions about the illustrations. I will continue to think about how to better adapt the book structures and my introduction of them to the more open-ended requirements of the math story. The logistics related to both the management of the materials and teaching the structures were not as difficult as I anticipated. There is a great deal of teacher preparation going into the projects, but no more than preparing for the Time Travel Sessions or for some of the more involved science labs. The buy-in from the students for learning the structures they chose was great. The key is planning ahead and having a strong parallel activity for the rest of the class.

I would like to add at least one more book project next year. Some possibilities are a book, perhaps on heredity or a math topic, based on *The Important Book* by Margaret Wise Brown. Or students could make mini-books reviewing and explaining the relationships between fractions, decimals, and percent or other math topics. Another possibility is to take a subject like Human Systems or Invertebrates or Drugs and have each student or small group of students become expert in one system or animal or drug and then create a trading card to share that knowledge. Students would make a book with an overview of the subject and pockets to keep copies of the trading cards together. Book structures would be a good way to add an assessment to a unit like genetics where I currently have no culminating project or test.

The question becomes not whether to integrate book structures in the seventh grade math and science curriculum but how many to include in any one year. Although the preparation time and the time to teach the format were less of an issue than I expected, they are a factor. The arguments in support of book structures: student ownership of material, students thinking

about the material in new ways as they put it into the format and see new patterns and relationships, students involving more of their senses in their learning and retaining more of the knowledge, accommodating students with different learning styles, open-ended projects students can take where their interests lead. The arguments against too many projects: challenging to students with grapho-motor issues, gorgeous books that don't follow directions or have poor content, and time. As with other issues of curriculum and assessment, the key is to find the right balance – for student interest as well as teacher time. For next year, I think that will look like one simple structure early on with all the students and then three projects with a choice of structures.