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Exploring Perimeter and Area with 4th Graders

Amber Lieberg Winkler

Introduction

I am going to teach basic introductory geometry skills to 4th graders using Geometry's Sketchpad. At this age, children are only beginning to learn about geometry in their math classes, and I would like for the students to understand these basic concepts using technology. This problem is so important for the students to learn early, and learn correctly. These skills will involve finding the area and perimeter of regular polygons, basic skills using Geometry's Sketchpad, and activities that will apply these introductory concepts; directly correlating within the national geometry standards of mathematics. Children use geometry everyday, even when they don't realize they are using them (actually we all do). But the most important concept for the children is to recognize shapes and structures. If they can identify the use of geometry, then it will automatically trigger the children to think; think in a mathematical state of mind. Thinking mathematically creates questions and also answers questions.

With Geometry's Sketchpad, children can learn these skills much earlier because they can construct, observe, calculate and assess everything independently. Fortunately this contemporary technology is becoming more available in elementary classrooms. These concepts are most likely new to the students at the lower levels; therefore, teaching basic Geometry's Sketchpad skills to 4th graders will be a great introduction to beginning geometry. According to the national geometry standards for fourth graders, children will be able to analyze characteristic and properties of two-dimensional geometric shapes and develop mathematical arguments about geometric relationships. In these activities, I will explain the basic concepts of perimeters and areas of polygons with and without Geometry's Sketchpad. I will then give specific instructions on how to use the Sketchpad, next I will transition into three fun activities where the students can use what they've learned and understand how these skills can be associated with their own lives. These activities will include the national standards by having the children specify locations and describe spatial relationships using coordinate on Geometer's Sketchpad and other representational systems such as the geoboards. This will not only give students a fundamental introduction to geometry, but will provide them with knowledge for future application. Most importantly, students will become aware how mathematics and specifically geometry can be used in their everyday lives. Again incorporating these national standards by using visualization, spatial reasoning, geometric modeling to solve problems and apply the problems to analyze mathematical situations.

Literature Review

Using the geoboard is a great way to introduce the perimeters and areas of polygons to 4th graders. Of course, the children will already have been introduced to the definition of polygons in previous lessons. The geoboard can be used to teach geometric and algebraic concepts informally. A student can find the area of a polygon or perimeter using the each square that can be counted. With geoboard exercises, the students can visually calculate and grasp the basic concepts of straightforward and uncomplicated geometry. The idea of using this technique to teach the students about the perimeters and areas of objects is a great introduction if only whole units were involved because it is hands-on and practical. For more advanced students, use basic fraction units to enhance their learning experience.

This connection is simple because it basically gives me a formula of how to introduce a form of geometry to my students in the classroom for fourth grade students. This is beneficial because there are many facets to geometry, and this is only one of those facets. But I believe that it is a demonstration that the children will understand and learn fairly quickly from. Using the geoboard, the children can work with the rubber bands with their hands; it is not abstract to them. Since this is an age in which children don't know too much about geometry, this will be a great introduction.

Finding the differences and similarities between area and perimeter using Geometer's Sketchpad is the beginning phase using a program for geometry. Geometry is integrally related to social studies and architecture, so if children can understand how geometry is used in everyday life, then we will have accomplished something with the kids. The purpose of Geometer's Sketchpad is to draw figures and calculate area and other measurements quickly and efficiently. Many conjectures and explorations using the computer as a vehicle will only enhance the essential skills for learning the material. Woodward and Byrd suggest activities that should precede the method presented in this article.

- 1) In early grades activities should involve covering a region with small sub-regions and determining its area by counting these sub-regions.
- 2) Using graph paper, dot paper, and geoboard may reinforce the concept of area while differentiating it from the concept of perimeter.

The importance of Geometer's Sketchpad is for students to learn as early as possible. Yet it is also important to use the instruments that are everyday resources such as the geoboard, graph paper, and dots. These are resources that can be used later in their academic careers, however. They can use Geometer's Sketchpad to begin their knowledge base and further continue their education of geometry skills.

Teaching children geometry can be a difficult task for many children. The key is to teaching them with many different approaches. One of those approaches being with square tiles. Similar to geoboards, the square tiles will allow the students to have firsthand experience with geometric shapes physically. Using these shapes, they will be able to determine the perimeters and areas of perimeters of the shapes that they make with the square tiles by counting both the sides and the shapes. This will make the concept of learning about perimeters and areas more visual to the students before they use 'abstract' technology.

Using square tiles allows the children to have a brief introduction to geometry for those individual students who don't feel as comfortable with the computer. Here, the students will learn the same skills, but in a different approach. Teachers who use alternative methods in presenting the information will allow more students to learn.

The use of technology is increasingly important and essential, especially the use of it in the schools. There is decreased emphasis on memorizing geometric vocabulary, facts, and relationships. There are several geometric investigations that were developed in the spirit of the curriculum standards and are appropriate for use at advanced elementary and middle school levels, as well as with older students. They encourage age exploration, creativity, and discovery. Triangle explorations and constructions using geometry's sketchpad in great detail can also be valuable. Technology is extremely important in today's society, so we may as well have children learn as early as possible.

For a weekly geometry lesson plan, teaching geometry's sketchpad is crucial. When I was looking for articles, I found articles that would have helped me as a child in the fourth grade. As a child, I hated traditional handouts, chalkboards, and textbooks. I just wanted to find

something that would motivate the children to learn about geometry, make it fun, and make it real using technology. Anyway, that's why assignments can be extremely effective on the children, so they can not only learn, but also remember and use the information. My plans for assignments are, to intrigue, teach, and have fun in the process and hope the children can take something from the lessons I have taught them.

Mathematics teachers and their students may utilize dynamic geometry software such as Geometer's Sketchpad in designing innovative approaches to proof and justification in geometry. Such software may encourage students to conduct a meaningful justification of ideas, create simple geometric figures and explore the figures' relationships. The software may also promote a better understanding of geometric problems.

Using software will allow students to begin their studies in geometry as well as technology at an early age. Using Geometer's Sketchpad is fun and easy to understand. Children can use this program for calculations, shape making, translations, relationships, etc. There are endless uses to these activities. Students will have a base of knowledge that will also contribute to other classes in their futures.

Applications

The students have already learned about all different kinds of polygons, and in these lesson plans, they will get to use a variety of resources to see how these polygons are used in mathematics. The children will learn using the Multiple Intelligences (Howard Gardner) so that each child has the opportunity to grasp these concepts through listening, watching, analyzing, and of course, "doing" the activities.

Introduction to geometry and review of polygons must come first. We will bring out our shapes and work with them a little, discussing their shape, their sides, their lengths, etc. I will also show pictures of how shapes are used in our everyday world (possibly a slide show). We will also bring out the geoboards and rubber bands to explore the relationship between the area and perimeter of the shapes, such as a square and rectangle. Possibly move into even triangles to challenge them, but it might be too difficult which is okay. Next we will also need to bring about square tiles so that the children can find and determine the relationships between the shapes of polygons and their perimeter and area.

We will move to the computers to have a completely run-through of Geometer's Sketchpad. The students will learn how to use all of the tools as well as measure the distances without having to measure them for themselves. I will let them explore the program, and hopefully show them how to use the technology to show them how to use the computer to perform the same skills that were previously learned.

First Application

Objective: To have children better understand the areas and perimeters of polygons using geoboards, shapes, and square tiles. It is a good idea to spread these different activities out for two or three days. Children will learn how to make shapes on a geoboard (explained orally). Each child will receive rubber bands to make their shapes from their worksheet that is handed out. They are then to figure out the area and perimeters of the objects by counting the squares or the dots of the geoboard. The same process is completed with the square tiles. They will be able to visualize the relationship between the shapes that they construct, and their area and perimeter.

Rubber bands and geoboards, or square tiles, will need to be handed out to each student. Instructions will be given to each child to keep their hands to themselves, as well as their rubber bands. Each child will also receive a handout of different shapes, of different measurements. We will review how to look at each shape, and review vocabulary.

Activities will follow. We will begin the first couple problems as a group. I will explain that each peg or square tile represents one unit, and if we count the pegs or sides around the shape, then we will be able to find the perimeter. The children will be able to do even more complicated shapes once they get the hang of it such as other polygons with many sides. Let the children work in pairs or groups to discuss and compare their findings. Let the more advanced students have more difficult measurements to challenge them. Then we will discuss the area of the shapes. I will explain that if we count all of the squares inside the shape, we will get the area of the shape. Once again, the students will be able to compare with the rest of their peers to complete their worksheet.

Discussion of what was learned is extremely important, as is taking time to answer questions. These activities tie into the national standards as well. Students will be able to visually analyze the properties of two-dimensional geometric shapes and develop mathematical arguments about the geometric relationships (perimeter and area). They will specify locations and describe spatial relationships using coordinate geometry and other representational systems (shapes, geoboard, and square tiles). Students will use visualization of our activities, form spatial reasoning, and geometric modeling to solve problems (through discussion and group work on worksheets).

Second Application

Objective: To have children learn fundamental skills about Geometer's Sketchpad through a series of exercises. These exercises will take the students through step by step how to create shapes, get their distances, etc. They will only have so much information at this point, but at least they will have some kind of experience using the computer, using geometry, and applying both concepts with the sketchpad.

This activity will be a series of exercises that are listed on a handout. The handout will mainly consist of triangles, squares, circles, and other basic shapes that the children have learned about.

- Each child should have his/her own computer, or sharing with one or two other students.
- Mostly, the assignment will consist of using the left tool bar so that they won't have to continually memorize which file to go under.
- After explaining what each tool demonstrates, such as the line segments, circle, text, and pointer tools, they will get to explore the shapes they make through these different tools.
- Once everyone has gotten a good chance to play around, I will show students how to construct segments from the top tool bar, make constructions, and show them how to use the color... because children love to make colorful objects.

The students now get the opportunity to make something, anything they want using the tools they learned about today. This will allow the children to be creative, and see how geometry is used. Maybe they can also come to the conclusion that technology is important and will play a very important role in their own lives. Let the children use their imaginations and have fun making their own geometric creations.

Students will then explore real-life geometry patterns on Geometer's Sketchpad to create objects that they themselves are familiar with. Children tend to take information in better and more efficiently if what they are learning can apply in some way to their own lives, or relate to something that is real. In this activity, I have chosen to real-life, scenarios in which a person would use geometry to construct something or help them with a problem. The children don't have to know or understand each concept, but it will give them the opportunity to see first hand how geometry can be used.

This activity is going to be fun for the children. They are going to construct pinwheels with the skills they learned from the previous lessons, and from my instructions. This activity called Dueling Pinwheels comes from Cynthia Lanius at <http://math.rice.edu/~lanius/misc/rotat.html>. This exercise will be fun for the children because most children like to play with pinwheels.

- 1) We will construct a circle, and two radii and a chord forming an acute triangle
- 2) We will then select the three vertices of the triangle and construct the polygon interior.
- 3) We will transform the triangle with my instructions and rotate by 60 degrees. (The children will not understand why we do this but they will get some experience in doing geometry sketches.)
- 4) We will then add color to each of the triangles, and we can then animate the pinwheel, which in turn shows the pinwheel spinning.

This activity would most likely take most of the time, but if I need a follow up activity, I could briefly show them or explain to them how we can measure the circumference of a broken plate that was found at an archeological dig. They probably won't understand the concept of this, but will be great information for them to take in. This will only add to the reasons for learning geometry.

These activities also require time, but cover the NCTM standards for mathematics. The children will be analyzing the properties of two-dimensional geometric shapes and develop mathematical arguments about geometric relationships (through exploration and the pinwheels). They will specify locations and describe spatial relationships using coordinate geometry and other representational systems (Geometry's Sketchpad). Last, children will apply transformations and use symmetry to analyze mathematical situations.

Conclusions and Implications

The articles and lesson plans that were used in this project are wonderful for students of this age group who are learning the fundamental skills of geometry with technology. Using technology at an early age is extremely important for students who are growing up in a 'world of technology'. It is great because students can begin more difficult concepts at an earlier age with this technology. Geometry's Sketchpad is just one technology program that students will not only learn beginning to more advanced geometry skills, but they will benefit from using the program at their own leisure. Technology can make learning fun.

Accommodating for each student's needs requires extra fine-tuning of the lesson plans. For student's whom are above the average, lessons take a lot of time and preparation to organize. I was very surprised at all of the work and organization involve in this process. Teachers today need to accommodate for every student; therefore, having alternative lesson plans for those who need to be slightly more challenged with their studies is required. Adding in extra activities and using more difficult scenarios, can alter these needs. One example might be with the geoboards and the square tiles, more sophisticated areas and perimeters could be used. With the geoboard,

shapes with triangular edges would create for a more difficult problem to solve the area and perimeter. Geometer's Sketchpad can be as simple or as difficult and complicated as you want to make it. If there are gifted children who need more of a challenge, extend the activities by adding in other translations, calculations, and shapes.

The students will get a lot out of these assignments. I really think that the students will learn significant skills, and have fun learning. Geometry can be really monotonous and boring, or it can be challenging and enjoyable for children. I think that when applying the curriculum to real-life experiences, learning is a much more interesting as well. Children like challenges, they like to move around and actively participate in many activities. Opting to incorporate lesson plans that students will really enjoy and partake in is so important to engage all students. Most of these lesson plans require a great deal of preparation, time, and even money (computers and program software). But when it comes down to it, it's imperative to love what you're doing and strive to meet the needs of each and every student. I know that I would never love what I was doing if the children weren't learning, having fun, and being challenged. That's what teaching is all about!

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