Froebel Gifts: A Tool to Reinforce Conceptual Knowledge of Fractions

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Abstract

In this manuscript, we review Froebel Gifts and its use as an effective, practical tool to teach and reinforce conceptual knowledge that students should acquire regarding fractions. Furthermore, we set forth and examine the different techniques and methods that can be used to explore this manipulative as a teaching material, and end focusing on the fifth Froebel Gift and several practical and interesting activities that can be developed with this material in class.

Introduction

The purpose of this article is to introduce some ideas to help students mature and reinforce the development of conceptual knowledge of fractions, by using the manipulative material Froebel Gifts. Friedrich Froebel, a German pedagogue and the founder of the modern Kindergarten Movement invented this manipulative material. Froebel was the first educator to believe that "the education of a child should start shortly after birth" (Provence, 2009, p.87). The educator's creation of kindergartens was a fusion of ideas from other important pedagogues of that time, like Fichte and Pestalozzi. Froebel believed that children are like flowers, the germination of humankind, and therefore need to be protected and taken care, like a garden. Based on the spiritual dimensions of a child, he developed a theory of play based on what he believed was a child's natural need for activity. According to Provence (2009), children's necessity to be active and to play meaningfully led Froebel to build what many consider to be his most significant contribution to education: the Froebel Gifts and Occupations. These are a group of twenty games and activities, essentially a "hands-on curricular system, intended to introduce children to the physical forms and relationships found in nature" (Provence, 2009, p.87). In fact, the first ten educational activities were referred as *Gifts*, and the other ten activities were considered as *Occupations*.

In Froebel's mind, these gifts were to work as tools to awaken and develop in children the recognition of the common elements found in nature (animal, plant, and mineral), and to then help understand how everything is connected by showing the interrelationship between the living and inanimate objects. Froebel's theories concerning education were based on the divine unity of nature, and were highly abstract and spiritual. Therefore, the sensorial development is a fundamental and basic principle. His models allow the translation of abstractions into more tangible and engaging educational activities and devices for children. The gifts, by this definition, were the first manipulative materials for early education. "It was Froebel who introduced the use of blocks on a wide scale into early childhood education (third, fourth, fifth and sixth gifts)" (Provence, 2009, p.88), and this system of blocks is presented to the children from the simple (third gift) to the most complex (sixth gift) block.

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In this article, we will explore the third, fourth and fifth gifts, since they are most relevant to teaching concepts with fractions. Finally, we will explore in more depth how to work with the fifth gift, which is considered one of the most important activities in fraction concept development.

Froebel Gifts

According to Thiessen (2005), the geometric gifts were a representation of his philosophy and beliefs about early childhood education, and they were used as play materials to help children think about and express certain ideas. Provence (2009) explains, "Froebel gifts were not only clever inventions, but wonderfully appropriate in terms of the cognitive and developmental needs of children." The gifts are a fantastic way to enhance the total development of children, giving them the opportunity to represent and express their thoughts and ideas. Children interact with each other and with their surroundings, and that interaction leads to learning and to the understanding and appreciation of the world. Froebel believed that children learn by doing, and that the recognition of this created respect for children's natural methodology of learning.

Gift Three

Gifts three through six are sets of blocks, each different from another but yet very similar. The third gift is basically a set of eight 2.54 cm wooden cubes (Figure 1). The cubes are inside a wooden box. According to Thiessen (2005), "this gift is the first of what Froebel called the building gifts where the emphasis is on taking apart and putting together, on seeing the parts in relation to the whole" (Thiessen, 2005, p.16).

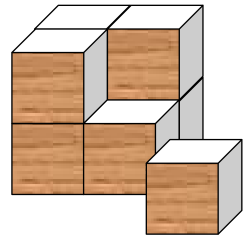


Figure 1

Froebel describes the third gift saying:
"The principal cube appears separated by the mentioned division in this play into eight equal cubes. The child thus distinguishes here as a given fact, and without any words (purely as the perception of an object), a whole and a part, for each component cube is a part of the principle cube. …Therefore by the simple play the fundamental perceptions, whole and part, form and size, are made clear by contrast, as deeply impressed by repetition" (Froebel, 1909, p.119).

"The third gift satisfies the growing desire for independent activity, for the exercise of the child's own power of analysis and synthesis, of taking apart and putting together" (Wiggin, 1986, p. 59). One way to play with the third gift is to ask children to stack the cubes in a variety of ways in order to represent things from their surroundings. As an example, a child can build a chair, a bed, or a train. The child can also use the cubes to build various symmetric arrangements, or even to introduce fractions where the eight cubes together are the whole, and each cube alone is a part of that whole. The teacher can teach the notion of fraction with the students, and introduce the concepts of halves, quarters and eighths. The use of models in fraction tasks is very important and can help students to elucidate ideas that are often confused in a purely symbolic mode. Many times it is useful to explore different approaches or models in the same activities.

Gift Four

The fourth gift is also a cube that has been now divided into eight equal rectangular prisms. Each rectangular solid is 1.27 cm by 2.54 cm by 5.08 cm (Figure 2). According to Thiessen (2005), Froebel introduced this gift as similar to the third gift. The box with the eight pieces is placed lid down and then the lid is pulled out and the box lifted up revealing the two-inch cube. Each of the four building gifts is presented like this because Froebel believed that the child should begin play with the gift in such a way that it would be perceived as a whole rather than several parts. In an advanced phase of learning, students are encouraged to compare the pieces of this gift with those of the third gift and realize that the volume of the eight cubes is equal to the volume of the eight parallelepipeds. In the fourth gift, the buildings are more complex and require better manual ability, equilibrium, and a high mental effort. Using the constructions as a background, teachers can develop logical mathematical concepts using real world problems.

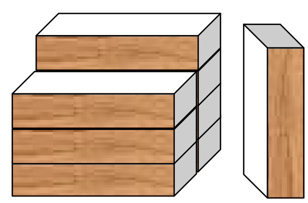


Figure 2

Froebel believed that the gifts created a progression such that each new gift was suggested by the previous gift and constructed upon it. While gifts three and four involved looking at dividing the two-inch cube in different ways, the cuts were always parallel to the faces. The next gift in the sequence provides yet another extension, one in which not only is the whole cube cut along planes parallel to the faces, but some of the resulting pieces are themselves cut into halves and fourths.

Gifts Five and Six

The fifth gift seems to be an extension of the third gift. It is made of 21 whole cubes measuring 2.54 cm, three cubes divided in halves and another three cubes divided in quarters (Figure 3). With this material it is possible to do several representations of the children's surroundings. These constructions can help students develop pedagogical awareness of equilibrium, laterality, spatial notion, counting, rationality, mental calculations, world problems, building of objects, creativity, and rational numbers.

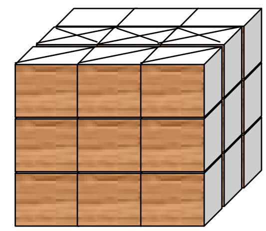


Figure 3

Gift six is connected with the fourth gift. The box is similar to the box of the fifth gift but inside students will find 27 parallelepipeds, in which six are divided in two vertically forming 12 square prisms, and three are also divided in 2 but horizontally forming six rectangular prisms (Figure 4). According to Thiesen (2005), the pieces of this gift can be used in an identical way as those of the fourth gift to correspond to a diversity of things in the child's environment.

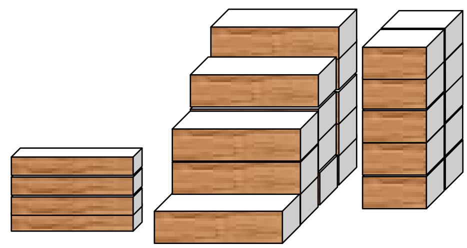


Figure 4

Using the Fifth Gift to Understand Fractions Connections to Standards

The topic of fractions is where students often give up trying to understand and resort to rules instead. This deficiency of understanding is then deciphered into untold difficulties with fraction computation, decimal and percent concepts, the use of fractions in measurement, and ratio and proportional concepts.

In the elementary grades, there are several activities that can help students to understand fractions and decimals, to explore their relationships and build order and equivalence concepts. According to National Council of Teachers of Mathematics (NCTM) (2000), it is important to use manipulative materials, diagrams and real world situations as a combination of progressive efforts to describe learning experiences, through language and symbols. They state that, "during grades 3-5, students should build their understanding of fractions as parts of a whole and as division" (NCTM, 2000, p. 150). Also, it is vital that they "see and explore a variety of models of fractions, focusing primarily on familiar fractions such as halves, third, fourths, sixths, eights and tenths" (NCTM, 2000, p. 150). Furthermore, by using region or area models, students will be able to see "how fractions are related to a unit whole, compare fractional parts of a whole, and find equivalent fractions. They should develop strategies for ordering and comparing fractions, often using benchmarks such as ½ and 1" (NCTM, 2000, p. 151). The Common Core State Standards for School Mathematics (2010) states that students should be able to "explain equivalence of fractions in special cases, and compare fractions by reasoning about their size; understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line; and recognize and generate simple equivalent fractions (e.g., 1/2 = 2/4, 4/6 = 2/3)". Then, for example, they should be able to "explain why the fractions are equivalent, by using a visual fraction model."

A Tool to Reinforce Conceptual Knowledge of Fractions

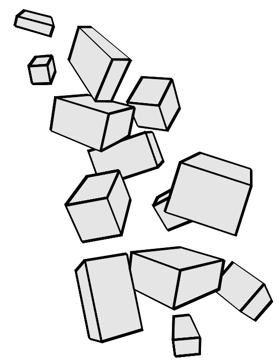
By using the fifth gift, students can develop the notion of number and easily realize that 1/2 represents the same portion as 2/4, and with similar examples, they will be able to better understand equivalent fractions. They also can verify that 8/4 is equal to two, as well as 4/2, and that both fractions represent the same number, the number two. Then they can realize that similar numbers can be represented by different fractions that are equivalent.

Additionally, students can visualize and perceive that 1/2 is half of a cube and that 2/4 of a cube is also half of a cube equally divided into fourths. That way they will be able to compare, order decimals, add and subtract fractions with the same denominator and also with different denominators without finding the common denominator. For example, they can easily add 1/2 with 2/4 and state that it is equal to one. Using the fifth gift, students can demonstrate that this is true by using half a cube and two quarters of a cube. Students should be able to create a multiplicity of examples, rationalizing about the relationships that they find. If given the opportunity and time to explore this gift, children can develop the capacity of thinking.

Using the Fifth Gift in the Mathematics Classroom

To begin using Froebel's fifth gift in the classroom, students should first explore the box as the teacher asks a few questions. For example, as the students observe the polyhedron, the teacher can ask the following questions:

1- How many faces, edges, and vertices there are?
2- What is the total number of cubes inside the box?
3- What is the total number of cubes divided into two equal parts?
4- What is the total number of cubes divided into four equal parts?
5- How many whole cubes are inside the box?
6- How many halves are needed to have one whole cube or two whole cubes?
7- How many quarters or fourths are needed to build three whole cubes?
8- How many whole cubes are needed to have 4/2?
9- How do you find equivalent fractions by using the halves and the quarters?



These are just examples of questions that can be used while students explore the fifth gift. There are many other relevant questions that can be asked to promote student exploration of this gift. There are several other ways to explore fractions by using these gifts (third, fourth, fifth and sixth). The teacher can explore equivalent fractions, addition and subtraction of fractions, and compare fractions by using benchmarks of zero, half and one.

As mentioned before, one of the most valuable activities of this kind of manipulatives is the possibility of doing constructions using all 27 cubes. For this particular fifth gift, there are several predefined constructions (house, warehouse, church, beehives, grandfather chair, sofa). Nevertheless, children can also use their imagination and explore the material to build their own constructions and share with each other. From that, the teacher can explore these constructions by doing real world problems that include the use of fractions.

Another activity for the fifth gift is to build symmetric shapes. Using all 36 pieces, 27 of which are cubes, the possibilities for making symmetric arrangements of the pieces is seemingly endless. According to Thiesen (2005), in building such arrangements, "Froebel emphasized the importance of having children create successive arrangements by modification of previous arrangements." (Thiessen, 2005, p.21)

Conclusion

The possibilities for representing concepts and relationships of shape and number are greatly increased with these gifts and clearly the possibilities go beyond what can be expected of a kindergarten child when using the more advanced gifts. For the fifth gift, early activities involve separating the cube into congruent thirds in different ways, then into ninths, and finally into twenty-sevenths. The half and quarter cubes provide the opportunity to make more interesting subdivisions into congruent pieces. The pieces can be divided into two, four or six, and 12 congruent arrangements. Froebel emphasized the importance of thinking about how pieces can be put together and taken apart, and this emphasis can be used in gifts three through six. The Standards for Mathematical Practice (SMP) in the Common Core State Standards for School Mathematics enforce practices that all teachers should be using when teaching children. Using spatial manipulatives such as Froebel Gifts can help enforce the SMP's, from SMP 3 (construct viable arguments and critique the reasoning of others) to SMP 4 (model with mathematics), these tools can promote mathematical student discussions which can only enhance their spatial knowledge and understanding of fractional concepts.

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