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## NEW PROSPECTS FOR TEACHING SCIENCE IN KINDERGARTEN. THE SCIENCE STORY CASE

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### ABSTRACT

The story is a good way to teach children different subjects and explain phenomena in kindergarten. The science story teaches the pupil scientific phenomena in an indirect way. Phenomenology is another way to learn about similarities among various materials without using the senses of taste or smell. The focus concentrates on the scientific method. Here, the scientific idea is that not all materials with similar external characteristics are the same. Therefore, the child must be careful. The role of the science story today introduces a new and pioneering method in teaching some aspects of scientific knowledge, such as facts and concepts, using stories to attract children and lead them to reason logically.

**Key words:** Science story, scientific phenomena, teaching.

### RESUMEN

La historieta es un buen camino, en el kindergarten, para enseñar a los niños diferentes materias y explicarles algunas fenomenologías. La historieta científica enseña una fenomenología de forma indirecta. La fenomenología es otro camino para conocer materiales que tienen semejanzas, sin usar los sentidos del gusto y del olfato. Todo se centra alrededor de la idea científica. Aquí, la idea científica es que no todos los materiales con similares características externas son iguales, y de este modo el niño debe ser más cuidadoso al hacer sus apreciaciones. La historieta científica asume hoy un nuevo papel como método pionero en la enseñanza de algunos aspectos y conceptos del conocimiento científico atrayendo y motivando al niño a formarse imaginarios razonables.

**Palabras clave:** Historieta científica, fenomenología, fenómeno científico, enseñanza.

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### INTRODUCTION

Scientific activity must be done within the framework of the scientific system. Scientific activity with children must be conducted under conditions that are appropriate to the young child and that appeal to him. Such conditions include

components of drama, movement, and plastic art within science. The holistic approach is appropriate for scientific subjects, and there is no need to separate the scientific subjects from the other subjects taught at in kindergarten, but rather to combine them (Cannon 1996.; Fromberg 1993.; Howe, C.A., 1993.;

Krajcik, J., 1993.; Kusland, I.L.; R.E., Bliss, J., 1995.; Rockwell, R.E.; Scharmann, L.C., 1996; Sherwood, E.A., 1997.; Stavy, R., 1991; Stone, A., 1972.; Williams, R.A.; Yager). Children sometimes find it difficult to express themselves literally. Thus, children should be given the chance to do and show things rather than only talk about them. This provides children with the possibility of repeating activities and experiences to achieve a deeper understanding of the subject. Furthermore, it is working with children scientifically by observation, classification, measurement, use of time and space relations, communication, reaching conclusions, and use of numbers. Similar scientific activities are conducted to emphasize research proficiency and to learn scientific investigation. Such proficiencies include abilities to reflect, distinguish, classify, compare, raise questions, formulate hypotheses, and the ability to relate among space, time and causality (Cannon, J.R., 1996.; Fromberg, D.P., 1993.; Howe, C.A., 1993.; Krajcik, J., 1993.; Kusland, I.L.; R.E., Bliss, J., 1995.; Rockwell, R.E.; Scharmann, L.C., 1996; Sherwood, E.A., 1997.; Stavy, R., 1991; Stone, A., 1972; Williams, R.A.; Yager, 1-8).

The story is a good way to teach children different subjects and explain phenomena in the kindergarten (Helper, S.; Hickman, J.; Huck, C.S., 1993; Shavit, Z., 1986, 9,10). Before we choose a story to introduce in front of the children, we must ask several questions, such as: Can the subject of the story be found in the cycle of the children's attention? Can the subject be introduced in a way that gives a new expertise the children would achieve easily? What solution does the story give?

To answer these questions, we must be careful to choose a story for the children and we must take into account several

points such as (Helper, S.; Hickman, J.; Huck, C. S., 1993; 9, 10):

- Match the story to the children in several age groups.
- The subject talks about life experience similar to that of the children's immediate environment.
- The story heroes should be well known from the immediate environment of the children, such as family, neighbors, animals and/or plants. Any types of heroes should react like human beings in their relations and emotions: speak, cry, play, and feel happy or sad.
- The way that the story introduces the general idea.
- The solutions that the story gives should be acceptable and effective.

The story's influence on the child's imagination (Helper, S.; Hickman, J.; Huck, C.S., 1993; 9, 10):

- a) The story uses intellectual aspects, such as imagination, intelligence, memory, conclusion, understanding and acceptance; all of these elements are linked to the imagination.
- b) The story exposes the child to different forms of excitement and different cultures.
- c) The story satisfies many aspects in the child, such as amazement, wonder and expectation of the unusual.
- d) The story opens before the child new domains of creativity and methods to adopt new ways of behavior. This aspect supports the capability to behave positively.
- e) The story gives the child a lot of information that the scientific subject cannot give him. Such information doesn't require a tremendous effort to be known and perceived.

- f) The story is a form of advertisement, and a means of tourism to other cultures and countries. For example, the story of "Alf Laila wa Laila" (*The One Thousand and One Nights*) gives the European child a tour to the countries of the East and shows him its varied magic.
- g) The story helps the child to spell the words correctly, and also to speak well.
- h) The story is a good means for teaching lessons.

Water is one of the most abundant compounds on earth. The accepted description for water worldwide is *a transparent and colorless liquid* (Huisman R., D.; and Louters L., L., 1999; Basheer S. and Hugerat, M. 2001.; Hugerat, M. and Nabwani, N., 2001. 11-13). Since kids in the lower grades often see warning signs such as "*Do not drink this liquid - it is not water*", one of the most popular chemistry laboratory activities in kindergarten is an observable change, such as a change of color, solubility, or electric conductivity (Huisman R., D.; and Louters L., L., 1999; Basheer S. and Hugerat, M. 2001.; Hugerat, M. and Nabwani, N., 2001 11-13). It has been observed that such scientific experiments have evoked the interest and the curiosity of kids.

We believe that presenting scientific laboratory experiments that demonstrate the inadequacy of the accepted description for water would be beneficial to teachers and their students (Huisman R., D.; and Louters L., L., 1999; Basheer S. and Hugerat, M. 2001.; Hugerat, M. and Nabwani, N., 2001 11-13).

"The Magic Liquid" Story (14):  
 "The farm of Uncle Said is beautiful. It is green all over with lots of colored flowers.

On the farm, the dog Puppy, the cat Pussy, ducks, geese and hens live peacefully.

Uncle Said wakes up early, works diligently on his farm, cultivates the land, waters the vegetables and feeds the animals.

One day, Uncle Said felt a severe pain in his feet that made him stay in bed. The dog Puppy called all the farm animals for a meeting in order to help Uncle Said in running the farm affairs.

Lulo the hen gathered her chicks and said, "I am going to look for grain in the surrounding fields. Please, stay inside the farm with Puppy and Pussy".

She pointed to the troublesome chick and said, "You make sure to stay with your siblings and near the pen".

The chicks replied, "We promise you, Mammy".

The chicks began to jump around, and Pussy the cat meowed! Suddenly, Pussy noticed that the troublesome chick was not present. She rushed to look for him. She heard a cry. "It is the troublesome chick!" the cat Pussy said.

She went toward the sound and there he was: the troublesome chick was lying on the ground coughing and crying, "Ku, Ku, Ku".

- "What happened to you?" the cat Pussy asked.
- "I felt thirsty; I went to look for water and...". Before he finished his statement, he fell on the ground.
- "Help! Help!" the cat Pussy screamed.

Everyone on the farm hurried to help. They knew that the chick was in some kind of danger... the rooster, who was a physician, came over and examined him. He recommended the transfer of the chick to the hospital.

The hen felt very sad and prayed to God to be merciful to her little chick.

The chick remained three days in the intensive care unit. After one whole week, he recovered and came home safely to the farm.

Everyone on the farm came to congratulate the little chick on his recovery. The rooster stood and asked everyone to pay attention. He brought three glasses filled with clear liquid and asked, "What do you see inside the glasses?"

All of them were surprised by his question. They began to whisper among themselves, "Of course, water! All the glasses are filled with water!"

Dr. Rooster then asked the rabbit to insert some leaves of red cabbage inside a glass filled with hot water. As a result, the color of the liquid turned purple. The rooster poured a few drops of the purple liquid into the three glasses.

- "Wow!" Everyone screamed loudly. "Purple...Red...Green... Dr. Rooster is a great magician".

The rooster replied in a loud voice:

- "Look carefully! The purple color has not changed in the first glass, because it has water in it. But, it has changed in the other two glasses. This proves that the liquid in the other two glasses is not water. Therefore, we must not be deceived and think that every clear liquid is water. This is what happened to our friend, the troublesome chick. The clear liquid he drank was not water. It was one of the dangerous pesticides that Uncle Said uses on the farm".

Dr. Rooster added in a sharp voice:

- "My dear friends, you must be very careful when you drink, because *not every transparent liquid is water!*".

#### **Operative method in kindergarten:**

1. The teacher brings a head of red cabbage and three glasses numbered from 1 to 3. She fills the glasses with soda water, cooking vinegar and water without labeling the glasses.
2. The teacher prepares the red cabbage juice by placing the cabbage leaves in a transparent container and adding warm water to it. After a few minutes, the cabbage juice will appear as a purple color in the container. Then, it may be strained and put aside.
3. The teacher asks three pupils to volunteer by tasting one of the glasses in front of the class using a teaspoon. Then, the rest of the class will be asked to explain the reactions of the three volunteers following their tasting of the liquids in the glasses (Diagram 1). The teacher asks the volunteers to express their feelings and whether they know the liquid they have just tasted.
4. At this point, the teacher starts to read the story until she reaches the episode where the troublesome chick drinks the unknown transparent liquid.
5. The teacher opens the discussion in the classroom around what has happened to the troublesome chick, and whether his behavior was appropriate, and to link that to the tasting of the liquids in the three glasses by the volunteers at the beginning of the period. The teacher may also ask about how one could help the troublesome chick and how the children would behave if they were in his place. Other questions that the teacher should ask:

- Have you ever drunk a liquid thinking it was water?
- Have you ever heard that one of your friends had drunk a liquid thinking it was water? Was he/she taken to the hospital?
- What would happen to you if you drank a dangerous liquid that looked like water?

The teacher should emphasize that it is dangerous to taste unknown materials.

6. The teacher conducts the experiment gradually by induction according to the following steps:

- Place the three glasses on the table in front of the class marking the glasses numbers 1, 2 and 3, containing water, vinegar and soda, respectively.
- Ask one of the children to add a small quantity of cabbage juice to glass number 1. Ask the children to observe the changes in color and what the final color of glass 1 is. It should be purple.
- Ask the children what color they expect in the second glass *before* adding the cabbage juice. The majority is expected to say, "Purple". Ask the children about the reason for their choice of color.
- Ask one of the children to add a small amount of red cabbage juice to glass 2, which includes vinegar. Then ask the children to name the color obtained (It should be red).
- Ask the children what color they expect in the third glass before adding the red cabbage juice. At this point, the children may understand that a third color will appear, and therefore they select new colors. The children's answers may be different; the teacher is advised to discuss the children's choices.

- Ask one of the children to add a small amount of red cabbage juice to glass 3, which contains drinking soda water. Then, ask the children to name the obtained color (It should be green).

7. Here, the teacher continues the story of the rooster and rabbit conducting an experiment.

During the experiment, the children should be trained to taste some materials in order to identify them. It must be clarified that not everything may be discovered by taste. The teacher is advised to assure the children that none of the used materials used in the experiment is harmful. Nevertheless, children should refrain from tasting unknown material without the permission of their parents, teacher or another adult known to them.

Through the suggested activities, we present a method to discover similar materials without the use of the sense of taste. Using research and discovery methods and going through a few steps, the children reach the conclusion that similar materials may indeed be different, without the need to taste any of them.

Step one includes the problem statement, presentation of the materials and formulation of the hypotheses.

Step two includes the simple instruction from the teacher to about the method of conducting the experiment.

Step three includes carrying out the experiment step by step.

- The child adds the red cabbage juice to glass 1.
- The child records the outcome. Here, the child learns an important step in scientific

research; that is, to record the results of each step of the experiment.

- The teacher asks the child about what he expects in the following step. Here, the child learns another important thing in science research; that is to formulate hypotheses.
  - Here, the child carries out the second step of the experiment by adding red cabbage juice to glass 2. At this step, the child tests the hypothesis.
  - After finishing the experiment and having recorded results, the children examine their hypotheses and make decisions to accept or reject them.
  - The last is the conclusion and generalization step. (In this experiment, we learned how to identify materials without having to taste them. We also learned that not every transparent liquid is water).
8. At this point, the teacher finishes the story. Immediately, she asks the children about their heroes in the story (Figures 2 and 3). In Figure 2, one of the children selected the rooster, who played the teacher explaining the subject of transparent liquids to the animals on the farm. When the teacher asked him to justify his selection, he expressed his desire to be a science teacher in the future. In Figure 3, a second child selected the rabbit for his hero, expressing a desire to become a laboratory worker in the future.

Obviously, teaching science through stories encourages the child to select the science professions in the future and to link science topics to daily life. What Kind of Story is “The magic liquid”?

In this story the animals are presented as they are, but sometimes they are spea-

king, and these animals are presented as having a human likeness. This story is apparently about animals, but actually tells about human beings and about things that have happened to them.

In this science story “The magic liquid”, we connect several kinds of stories together, such as

- a. The imaginary story: It is characterized by freedom of imagination, and escape from the normal. Here, all of the characters are animals, but they are speaking and behaving like humans.
- b. The scientific story: The science story teaches the pupils scientific phenomena in an indirect way. The phenomenology here is another way to know about similar materials without using the senses of taste or smell.
- c. The idea story: It focuses on the scientific idea. Here, the scientific idea is that not all materials that have similar external characteristics are the same, and the child must be careful.
- d. Incident story: the focus here is on what is happening ignoring the characters. Here, the important thing is what happened to the troublesome chick and how the rooster behaved to help the troublesome chick and teach all the animals on the farm.

The pedagogical aspects of this science story, “The magic liquid”:

1. It is possible to introduce the science story before the children just because the children like to listen to a story; this aspect helps each child to understand the scientific idea in the way he likes.

2. The story is an indirect way to give children new information; here we give the child new information about water; we prove that not every transparent liquid is water. We also give him the warning sign to be careful and not to drink every transparent liquid.
3. The child considers the story a game that he can play or a drama that he can act out in the classroom. At this point, the teacher can ask the children to play a game or make a drama and they can do the activity to check the three different liquids; one of the children acts as Dr. Rooster the physician; another acts as the rabbit who helps the rooster to do the experiment in front of the other animals on the farm; and they can do the activity together inside the classroom.
4. The story can be a window to the emotional world of the child, and a way to satisfy his needs when he thinks that he is the hero of the story. On the one hand, some of the children will learn that it is not so good to be like the troublesome chick; therefore, you must listen to your mother and be careful not to touch strange or unknown things. On the other hand, it is good to follow the role model of Dr. Rooster who helps people.
5. The science story excites the imagination of the child and supports new elements of his imagination. In this story, the child makes the connection between imagination and reality. The animals behave like people; for example, the rooster does the chemical activity in front of the animals. This activity is very simple, and the children may do it as an experiment in class.
6. The science story helps the children to diminish their feelings of fear in front of adults, and helps them to shape their

independent personalities. We think that during the telling of the story to the children, they know that it is possible that they can behave like adults, such as Dr. Rooster, or have the possibility to work as a chemist while conducting experiments.

## CONCLUSIONS

The role of the science story today presents a new and pioneering method in teaching some aspects of scientific knowledge, such as facts and concepts, using the story to attract children and lead them to reason logically. This is a suitable and much loved method among children through all ages and levels. It creates enthusiasm and stimulation among them to learn. Teaching science, after all, aims to use the story method in order to promote the functional perception of information and to improve the skills of scientific thinking among children.

Use of scientific stories in teaching is not different from other teaching methods, in the sense that it is a means to lead to an objective. In this case, the objective is relevant to perceiving scientific methods of thinking, promoting learning skills and providing opportunities for the children to have practical training, in the hope that they will adopt a method of thinking that is reasonable, constructive, practical, analytical and to the point.

As we use this method, the scientific story should be supported by related events and told in simple and correct language. The teacher is advised not to exaggerate at the imaginative points in the story, and to ask apt questions at the end, leading to the suitable and appropriate conclusions from the story.

The teacher's role is highly significant in guiding the children and assisting them to understand the story events and theme



through an effective manner of thinking. The teacher also helps the children to adopt the scientific method of reasoning, to improve their analytical ability by formulating hypotheses, gathering relevant information, testing the hypotheses and reaching sound conclusions.

Recently, and due to the importance of the subject, the Children's Literature Center in the college has published a series of scientific stories.

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(a)

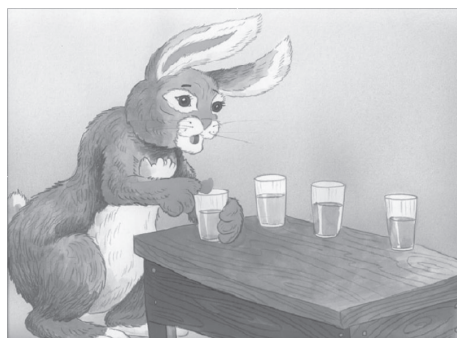


(b)



**Figure 1.** (a) extracted from reference 14, (b) pupils conducting the same experiment as in (a) in the kitchen. The child on the left playing the role of the teacher as the rooster in the story.

(a)



(b)



**Figure 2.** (a) extracted from reference reference 14, (b) the child conducting the same experiment as in (a) in the kitchen. The child on the right playing the role of the lab person as the rabbit in the story.