

Natural sciences in early childhood: Teaching magnetism to preschool children using Information and Communication Technology

Stavroula Skothou

Maria Trapali

Department of Biomedical Sciences,
University of West Attica, Athens, Greece

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Abstract

The aim of this publication is to report and approach the field of science in preschool age. More specifically, through the field of natural sciences, the approach of the concept of magnetism, the properties and types of magnets was chosen based on the interest of children. The realization of the educational process started with a set of planned activities undertaken by the educator and then the use of communication and information technologies was integrated, with a series of educational software and tools used by the children. The creation of an improvised story, a fairy tale scenario was the springboard for the realization of the respective activities and then through the use of Information and Communication Technology (ICT), an attempt is made to verify the aforementioned knowledge about magnetism and magnets. The use of the above technological tools and software is a decisive factor both for the repetition of the knowledge already acquired and for the use of new technological tools that will provide a challenge for the development of the pedagogical process.

Keywords: Preschool, magnets, magnetism, science

Introduction

Magnetism in early childhood

The main aim of this teaching intervention is to help children to approach magnets and magnetism. More specifically, the implementation of the teaching intervention concerns the appropriation of the properties of magnets in relation to other magnets, but also based on their interaction with various materials, the identification by children of the magnetic field, through activities that are meaningful to them, and that challenge them and at the same time invite them to participate in them. At this point, an important factor is the use of ICT in preschool, where through modern science children better understand the phenomenon of technology, information and communication and the possibilities that can be applied in preschool, hoping to promote a more advanced development of children (Zhao J et al,2022).

The use of ICT in pre-school education tries to focus on different aspects, related to the subject matter, recognizing the opportunities for learning and the risks that may lurk, discovering new trends for further development (Kremer M et al, 2013). Some of these characteristics of children are physiological limitations, the inability for abstract-thinking, reduced ability to concentrate, and animism-anthropomorphism. Some of these characteristics of children are physiological limitations, inability to abstract-abstract thinking, less ability to concentrate, animistic-anthropomorphism (Barra CL et al, 2023).

The younger the child is, the more obvious are the characteristics listed above. Being teachers, in order to organize science activities that make sense to children (Fig.1) and to choose appropriate software where children will experiment, these specific characteristics must be respected so that children can respond to all of the above and the goals set previously are realistic as well as achievable (Holm A et al, 2023), (Chan DK,2024). The topic of magnets-magnetism therefore belongs to the subject of science; however, a fairy tale was chosen to be used as a medium for the children to experiment with (Aboud KS et al, 2019), (Pulimeno M et al, 2020), (Wallance R et al, 2019), (Goodwin SC, 1997). The fairy tale "The Adventures of Takis Magnetakis" was written with these characteristics in mind. An effort was made to take the above characteristics of children into account in order to transform scientific knowledge and to adapt the expected cognitive objectives to the children's needs (Raptis & Rapti, 2007).

Based on the subjects covered by the fairy tale, the corresponding activities-experiments were designed and the corresponding software was selected with the use of technology in order to approach the concept of magnetism and magnets and to be able to acquire some knowledge about the above concepts.



Figure 1. Teaching preschool children

Presentation of activities

Title of the activity 'Do you want to be friends'

Objectives/Scientific Ideas Expected Schemes

- To arouse students' curiosity and satisfy their need for action and experimentation.
- To get children to approach some characteristic properties of magnets, in particular the attraction of magnetizable materials (distinguishing magnetizable materials from non-magnetizable materials).

Description

The children are divided into groups. To explore the topic, the teacher starts reading the first part of the story 'The Adventures of Takis Magnetakis' to the children and stops at the point where the magnet is stuck to the fridge. At this point the teacher traces the children's ideas about magnets. Then the groups of children, having been provided with the materials that the hero of the fairy tale encounters, are invited to experiment with them and come up with whether they become friends or not. After separating the materials based on their behavior when they approach the magnet, they classify the materials into a log table (objects that are magnetized and objects that are not magnetized).

First part of a fairy tale

Takis, the round little yellowish-marble magnet from Magnesia lived in the house of Mr. Ektismonakis. He carried with his south pole, a small

notepad of notes. On it the people of the house wrote things they had to remember. When the pad was finished, Takis would step out of the fridge for a while to stretch his legs and then return to his seat to hold a new pad of notes. Up there in the fridge where he lived, he could see everything. He had the whole world at his feet. And... not only that! He had also acquired a very good friend, the fridge, and even though they were separated by the notepad that never spoke to them, as it didn't fit in their company, the two of them day and night and their conversations dragged on for hours. Just as they were drawn to each other. Takis was happy with his life.

So, he thought...

One day, Mr. Estiemonakis pulled out a sheet of paper with force. Takis did his best to hold the block in place but he couldn't. He fell down hard. It jerked away, spun on the tiles for a moment and stopped. He stopped in the corner by the kitchen door, the north pole facing the ceiling. In an instant, his life was turned upside down.

Or so he thought.

Mr. Scientist looked for him, couldn't find him, and put in a, what did he call it...Ah! Blue tack until he bought a tape recorder. On leaving he passed him, and so as he tried to get the keys out of the door, chop! He dropped them! Straight away Taki just felt the keys close by, felt a pull and stuck on them, without Mr. Scientific being aware of it.

Whew! Okay Takis sighed " I've made myself comfortable again and something tells me we're going to make great company!"

He thought so...

The plastic key chain that supported the keys ostentatiously disdained Takis and only the keys attracted him and they became inseparable. And what Takis did not experience on the keys of Mr. Etiemonakis. When he entered his portfolio, he beheld all sorts of things! A yellow chalk for the blackboard of the University, you know, but which wanted to be left alone, like a lemon! "He's probably got the color!" he thought. But also, a big paperclip that, on seeing him, ran quickly over to greet him and never leave him again. And he saw a glass marble, of a cold blue color, which did not even react to the sight of Taki. And a wooden pencil that stood there unmoving, unmoving, upright, ready to "mark" another page. But also, a handkerchief that was prolonged further along, seemed inaccessible, unapproachable, unapproachable. But it had to be taken out again and put into other bags!

In the supermarket bag, for example, he got a close look at the smelling fruits and vegetables, but...they didn't click. Instead, a fine 9V

battery caught his eye and they became friends at once. In the sea bag, there you see! He met a rock and a pumice stone for the first time. But even the pumice stone seemed heavy and weightless. And what can I tell you about the mirror! Wouldn't Takis ask, "Mirror, mirror, mirror, is there a more beautiful magnet in the world?" The mirror nothing. On the other hand, the peg that fastens the towel came briskly up to him and told him he could trust his iron arms.

"I've seen it all," thought Takis.

So, he thought.

Returning from the sea, the lady of the house took the keys and "Oh, what have we here? A magnet has pulled a bunch of iron objects!" She grabbed Takis by the north pole, pulled him hard and threw him onto the entrance landing.

"That's it, it's the end of me..." Takis whimpered.

So, he thought.

The next day, while Mr. Science Man bent down to pick up his morning paper, what did he see? 'Our old magnet...what on earth is he doing here?' he muttered. He picked it up and tossed it into the tool box.

Taki found himself between a screw and a nail.

'There he is,' the fine-tipped screw said to him. "What news from outside?" The tiny nail asked him from his corner.

"Ah here's good company!" Takis thought.

So, he thought.

Activity title 'I'm attracted - I'm not attracted'

Objectives/Scientific Ideas Expected patterns

- To approximate some characteristic properties of magnets- Magnets have two poles- To discover the attractive property between heteronymous magnetic poles- To discover the repulsive properties between like poles of magnets.
- To introduce children to the concept of magnetic field.

Description

The teacher starts reading the second part of the fairy tale 'The Adventures of Takis Magnetakis'. The children are divided into groups and each group is provided with two magnetic rings that they can use for their experiments. The educator encourages the children to manipulate the magnetic rings and through the experimental process to discover experientially the attraction that occurs between two magnets of identical

poles and the repulsion between similar poles and finally to discuss the results of their activities.

Second Fairy Tale Part Two

Takis the little Magnitakis had great adventures as a child, and one day, like all the others, he ended up in a paper box and there he saw something he had never imagined before! He saw a purple-yellow round and beautiful little magnet.

"Ah you look like a fairy," whispered the poor little magnet as if enchanted.

"Beauty of the world, wait, will you give me your name?"

"My name is simply called," said she, "Catherine the Magnet. What is your name and why do I come closer and closer to you?"

"My name is Takis Magnetakis and as for the irresistible attraction, I have no idea what's at play."

"My dear Takis Magnetakis, I knew you when I saw you behind that screw."

"Beautiful Katerina, I feel dizzy and shaky. And in the box, it's so nice, do you want to join me?"

She approached her south pole with his north because as we all know "North and north and south and south don't mix." As the saying goes, heteronyms attract!

"But let me tell you, my good and beautiful Takis magnet. Are you two going to be stuck together forever? I can't do the routine. I want my peace and quiet at least once a month!"

"Oh," thought Takis... "There's always a way to keep him from getting bored of me.

"We've managed that too! So, when you want to go for a walk alone, you'll turn your back on me and I'll be gone in a minute!"

Activity title 'Love goes through the stomach...'

Objectives/Scientific Ideas Expected shapes

- To arouse children's curiosity and satisfy their need for action and experimentation.
- To get children to approach some characteristic properties of magnets, in particular the attraction of magnetizable materials and distinguishing magnetizable materials from non-magnetizable ones.

Description

The teacher begins the reading of the third and final part of the story 'The Adventures of Takis Magnetakis'. Then the children, seated in the plenary, experiment with the laminated cards that the teacher has placed on the floor, which depict sweets. An iron grommet is attached to the end of these cards with string. The children in turn appear with a ribbon on the end

of which a magnetic ring is attached. In this way, through experimentation, the children are able to fish out sweets and thus the materials that are magnetized and those that are not.

Third part of a fairy tale

...So, it happened! And because they say that love passes through the stomach, they went on amusement park rides and ate sweets...What a clashing and innocent game they played, what a ballerina they climbed... Takis did everything he could to prevent Catherine from being bored by routine. He even made a fuss. And the amusement park was just the beginning. What romantic excursions the two of them made to lakes and rivers for fishing, and to weightlifting competitions that Catherine liked... And it seems that they had a good time and we... better!

Activity title 'Conflict- Resale'

Objectives/Scientific Ideas Expected shapes

- To approximate some characteristic properties of magnets- Discovery of attractive magnetic property and distinguishing and non-magnetizable materials- Discovery of repulsive properties between like poles of magnets- Repeat objective.
- Children to approximate the intensity of the magnetic field.

Description

The children are divided into groups and each group is seated on a table, as the activity takes place on a smooth and flat surface. The teacher provides each group of children with magnetic rings and two cars with special holders for the magnets. The way in which the magnets are placed, make the little cars move closer to each other or further away from each other. The children are encouraged by the teacher to manipulate the little cars and magnets for a while in order to make them repel or stick-collision. In addition, they are instructed to experiment and observe the ratio of the magnets with respect to the strength of their magnetic field. The more magnets are on the cars, the more forcefully the latter collide and the greater the distance when they are repelled. That is, the increase of magnets is proportional to the increase of their magnetic field strength and vice versa.

Activity title 'Ballerina'

Objectives/Scientific Ideas Expected shapes

- To introduce children to the concept of magnetic field.
- To approach some characteristic properties of magnets -Magnets have two poles -Discover the attractive magnetic property between

heteronymous magnetic poles (by contact or at a distance)-Discover the repulsive properties between like poles of magnet poles.

Description

The children are divided into groups and each group is provided with a Styrofoam, which is attached to the table with paper tape. Attached to the styrofoam is a pendulum whose end is a magnet. The children are invited to experiment, to play, to cooperate and through the experimental process to discover experientially the attraction that occurs between two magnets of opposite poles and the repulsion between similar poles. The repulsion between magnets where one of them is the end of a pendulum is a quite playful process, as no matter how hard the children try, they do not manage to 'stick' the magnets and in this way the existence of a magnetic field around the magnets is approached in a quite obvious way.

Activity title 'Time for beans'

Objectives/Scientific Ideas Expected shapes

- The visualization of the concept of the magnetic field.

Description

The educator continues reading the third part of the fairy tale 'The Adventures of Takis Magnetakis' to the children, where Takis and Ekaterina's companion relationship begins with...cleaning. The children are divided into groups and each group is provided with a transparent box of iron filings and a magnetic ring. The children are not aware of what is inside the box and are encouraged to experiment and predict how the magnet can pull-pull-wipe. An experimentation begins about the 'behavior' of the dust when the magnet is approached, when it moves right, left, up and down. Ideally, in the first contact there would be iron dust on an A4 paste, which would be 'picked up' by the magnet, and in the second phase the dust in a box to emphasize the strength of the magnetic field and the fact that it can attract objects even when obstacles are interfered with. Because the overriding aim of the activity is to visualize the magnetic field and not the strength of the magnet to attract objects even when obstacles are interfering, particular emphasis is placed on the material of the box contents rather than the box-obstacle between them and the magnet.

Activity title 'Weightlifting competitions'

Objectives/Scientific Ideas Expected Schemes

- To arouse students' curiosity and satisfy their need for action and experimentation.

- To measure the 'strength' of different magnets/strength of the magnetic field of magnets.

Description

Children are divided into groups and asked to predict whether all the magnets available to them (bar magnet, horseshoe magnet, magnetic ring) have the same strength to 'lift' the same or different number of fasteners. They are then asked to find a way to check whether the magnets taking part in the weightlifting game are equally strong or whether one is superior to another. The results about which magnet is 'stronger' are derived from the results of measurements of the number of fasteners that each magnet 'lifts'. In this they need to perceive accurate measurement as a key factor in their investigation.

Activity title 'Fishing with obstacles'

Objectives/Scientific Ideas Expected patterns

- To arouse the curiosity of young learners and their need for action and experimentation.
- To get children to approach certain characteristic properties of magnets, in particular the attraction of magnetizable materials (distinguishing materials from non-magnetizable ones).
- To test whether magnets attract objects when obstacles of different material and thickness are inserted.

Description

The children are divided into four groups and each group is provided with a fishing rod (pole, rope, magnetic ring) and magnetizable materials (safety pin, double-ended fishing rod, iron rod, coin, pin, iron tools) as well as non-magnetic materials (craft stick, shell, glass, chalk, plastic toy, tulle, cloth, plastic piece) and an A4 glue, a piece of cardboard, a piece of cloth and a book of approximately the same size and thickness. The children experiment with whether the magnet will magnetize the magnetized and non-magnetized materials, despite the fact that an obstacle is inserted. Non-magnetizable materials are included in the experimentation in order to test the level of classification of magnetizable and non-magnetizable materials once again. The essential aim is for the children to act on the analogy that the thicker the obstacle, the more the force of the magnet cannot penetrate it.

Presentation of educational software-games

Use of educational software Little Artists in Action

Objectives/Scientific Ideas Expected Schemes

- To familiarize children with the use of the computer, mouse and keyboard.
- To experiment with searching for information and images on topics of interest.
- To identify among the many pieces of information those that will be useful in approaching the topic.

Description

The children experiment with the computer while at the same time starting a discussion about the usefulness of the instrument, how it works and the information we could extract about magnets and magnetism. The learning journey then begins, where through the basic search engine we are led to the use of the educational software 'Little Artists in Action'. One of the applications used was 'Let's draw together', where using different tools they start to form random drawings and then draw the heroes of the fairy tale 'The Adventures of Takis Magnetakis' and give shape to the magnets. Then the 'Learn to Draw' application is used, where the children practiced mainly the use of the mouse and keyboard, as it is a tracing technique where the drawings are preselected. Next app used was 'Draw with ribbons', where with a magic brush the children created magic magnets with different colors, trying to match the ones they could make together. Finally, the 'Print what you want on paper' app gave children the opportunity to print on paper pictures about magnets and magnetism.

Use of youtube website

Objectives/Scientific Ideas Expected patterns

- To familiarize children with using and searching on the computer, making use of the screen, keyboard and mouse.
- To discover that the you tube website is an easy way to search and find information through digital videos.
- To enable children to associate the image and its quick changes with the desired knowledge.

Description

The children came in contact with the computer and through the guiding intervention of the teacher we were transferred through the central search engine to the website of youtube. By pressing in the search field, the words magnets and magnetism, videos related to the above search appeared

immediately. The videos watched by the children were carefully selected by the educator, short including the basic information about magnets and magnetism. At the end of watching the videos, a discussion begins to establish the imprint of certain knowledge, which develops into a role play, where the children transform themselves into magnets that are sometimes attracted and sometimes repelled.

Use of an interactive whiteboard

Objectives/Scientific Ideas Expected Schemes

- To have children experiment with the use of the interactive whiteboard.
- To be able to participate in the same way and collectively in educational teaching.
- To attract children's interest.

Description

The use of the interactive whiteboard is done through the display of a folder with all the information acquired so far as well as the characters of the fairy tale and their adventures. All of the above is presented to the children through the interactive whiteboard and using mainly the corresponding pictures. Then after watching the visual material they continued their experimentation with the interactive whiteboard and more specifically the use of the drawing tool, where in turn the children imprinted with drawings what had been mentioned above. The children's direct contact with the interactive whiteboard offered them the opportunity to be able to practice on the theme and have fun at the same time.

Use of TYX PAINT digital drawing program

Objectives/Scientific Ideas Expected shapes

- To have children express their interests and capture their knowledge through the digital drawing program.
- To work together in order to achieve the desired result.

Description

The TYX PAINT digital drawing program offers children a variety of colors and tools, enabling children to create drawings with different tools than usual. By simultaneously reading the fairy tale 'The Adventures of Takis Magnitakis' the children created figures, faces, scenes and objects included in the fairy tale. In this way they started creating different magic magnets, as they described them with different colours that were sometimes close to each other and sometimes far away. Thus, they began to paint the

various materials that the magnets could bring near or drive away (magnetized and non-magnetized materials).

Use of HOT POTATOES software

Objectives/Scientific Ideas Expected Schemes

- To have the children experiment with the use of the computer.
- To introduce children to mathematical concepts such as the concept of matching and filling in blanks.
- To approach some characteristics of magnets and the magnetic field.

Description

The children were introduced to a series of online exercises whose preparation had been based on the age and abilities of the children. Therefore, the matching and gap-filling exercises were mainly formulated with images related to the types of magnets, magnetizable and non-magnetizable materials and the properties of the magnetic field. In both cases of exercises, the choice of pictures was chosen to replace the words in order to enable children to understand the content of the exercises. An important factor in the development of the activity was the cooperation between the children.

Use the STORY JUMPER tool

Objectives/Scientific Ideas Expected shapes

- The children will be able to combine the pictures with the corresponding texts in order to compose a story.
- To experiment in capturing their respective stories in pictures leading to the creation of a picture book.

Description

After reading the story 'The Adventures of Takis Magnetakis', the teacher encourages the children to create their own drawings, which will relate to the different scenes from the above story. So, while the teacher is reading the story, the children stop her at the points where they want to capture the moment from the story in their drawing. As the children complete the drawings the educator then asks the children to place them in a time sequence. The educator's concern is then to use the story jumper tool to create a picture book that includes both the children's drawings and the words of the story. Finally, the illustrated book can be distributed to the children and their families, but also a presentation can be made in the school premises in which the children, teachers and their classmates will participate.

Conclusions

This paper aims to introduce science to preschoolers through the creation of an improvised story and a set of organized activities and then through the use of communication and information technologies. The use of the story scenario was an important factor in engaging the children during the process of carrying out the teaching intervention. Subsequently, the proper use of ICT involves positive results for all involved, both for teachers and young learners. Active participation, continuous training and experience makes the respective teachers active in equipping the school units with a variety of technological means, which will be used in the realization of the educational process, especially when it comes to preschool children. Finally, young learners are placed in a new technological reality, which aims to enhance their learning development.

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