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ABORDĂRI STEAM ALE DRONELOR ÎN PREDAREA DISCIPLINELOR EXACTE

STEAM APPROACHES TO DRONES IN THE TEACHING OF EXACT DISCIPLINES

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Abstract. *In order to meet the requirements of the modern educational process, the teaching staff is always looking for another way of teaching-learning-evaluating the curricular subjects, relevant to the students' interests. Such a way can be given to us by drones, because with their help we can visualize the world with new eyes. Educational drones, in specialized literature, are also called aerial vehicles without a human pilot on board. This article presents examples of STEAM approaches to the application of drones in mathematics, physics and technology education. Thus, the following themes are researched: linear dependence, proportionality, quadratic function and quadratic relationship, area calculation, gravitational acceleration. The application of drones in other fields is also discussed.*
Keywords: *drone, addiction, STEAM, proportionality, acceleration.*

Introduction

21st century education must be dynamic and collaborative. That is why in every lesson we must have effective tools for managing the didactic process that will be able to provide instant and direct feedback from and between students, while preserving privacy, allowing even the shy ones to actively participate in the discussion and active learning. One such relevant tool could be drones. Due to the immense possibilities [1, p. 11; 2; 3, p. 5], these unmanned aerial vehicles can be implemented in various educational activities within the curricular subjects of general education starting with primary classes [1, pp. 41 – 53] and continuing in secondary schools [1, pp. 54 – 69] and high schools [1, pp. 70 – 91].

Thus, education can be accompanied by tools that are meant to enhance the learning experience to a fundamentally new level. Many educational drones are accompanied by software applications that themselves include simulations. This allows students to practice in a safe and bug-friendly environment before connecting to real drones and flying them. They also allow teachers to assign lessons to students for self-directed learning, as homework, or as project-based learning. Students don't need access to real drones to enjoy the excitement and engagement that UAVs bring. In different lessons we need to use different modern technologies that allow contextualization of education and help students bring abstract concepts to life. Interactive tools, within the subject taught, will be an additional layer, designed to help students express their knowledge, deepen their understanding and enable better retention of the subjects taught.

Application of drones within exact disciplines

We present here examples of STEAM approaches to the application of drones within the disciplines of mathematics, physics and technology education.

1. Linear dependence. Proportionality. In this lesson, by means of the drone, the concept of proportionality of a straight line $y = ax + b$ is demonstrated (fig. 1).



Figure 1. Linear dependence

After this lesson, students should be able to understand the concept of linear proportionality and will be able to apply the given concept to solve real-life problems.

The objectives of this lesson will be:

– students' ability to identify linear equations and their writing in the form of slope interpretation;

– students will be able to determine whether an equation results in a linear or non-linear representation;

– students will be able to determine the slope and variable y of linear equations by writing equations in the form of slope interpretation;

– students will be able to construct the graphs of linear functions.

2. Quadratic function. Quadratic relationship. This lesson demonstrates the concept of a quadratic relationship (fig. 2). After this lesson, students will understand the concept of quadratic proportionality and be able to apply it to solving problems in everyday life. This lesson demonstrates how a quadratic function can be graphed and how it relates to concrete cases. It also facilitates awareness of the relationship of a quadratic function to the physical world.

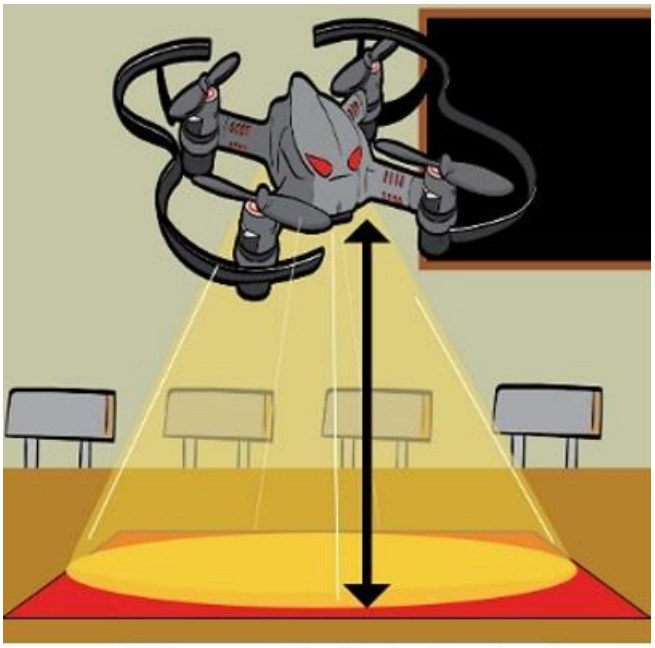


Figure 2. Quadratic function

One of the main goals should be to identify how changing the sides of the quadratic equation affects how a graph of the quadratic function will look.

3. Area calculation. Students will use a drone to calculate the area of the school campus, football, basketball, volleyball or simply the sports field. They will identify the relationships between the height of the unmanned aerial vehicle and the area that the video camera attached to the drone can see (fig. 3).

4. Gravitational acceleration. This lesson demonstrates the concept of gravitational acceleration, the opposing forces of gravitational acceleration, and the force that rotor blades must overcome (fig. 4). The main objectives of this lesson are recommended to be:

– identifying the influencing factors in Newton's second law;

– application of Newton's second law to real-life situations;



Figure 3. Area calculation

5. Drones in engineering. Within the technological education lessons, the following scenario entitled "Drones. Engineering. STEAM":

*What is engineering?*Engineering means finding a solution to a problem.

A question is formulated for which the answer is found (the question being the problem, and the answer being the solution). Engineers pay attention to what is happening around them to notice problems, then be creative, identify possible solutions.

What does STEAM mean?

STEAM comes from "science", "technology", "engineering", "art", "maths", five closely related fields. For example, engineers would not be able to do their jobs well without science, technology, art and mathematics. They use mathematics and other sciences as tools to solve problems and build different devices.

What will we learn?

Today we will learn interesting things about drones. We will see in what field they were first used and what uses they have recently received.

They were used for the first time in the military field.

What are drones?

Drones are devices that can perform various actions even in the absence of humans. There are drones that can operate on water and land. The most commonly used, for their increased utility, are flying drones. A flying drone with a camera attached can reach places that are difficult or impossible for humans to access, see things that are hard to see, without making the noise that other aircraft such as helicopters make. *The main elements of a drone*:

– a GPS chip for orientation;

– an altimeter for height measurement;

– an ultrasound scanner to determine the distance to the ground.

The drone is controlled by radio or WiFi signals. It has four propellers for stability and to be able to carry weights. It is often equipped with a video camera.

Which of the following missions can be performed by a flying drone (fig. 5)?

Can they...

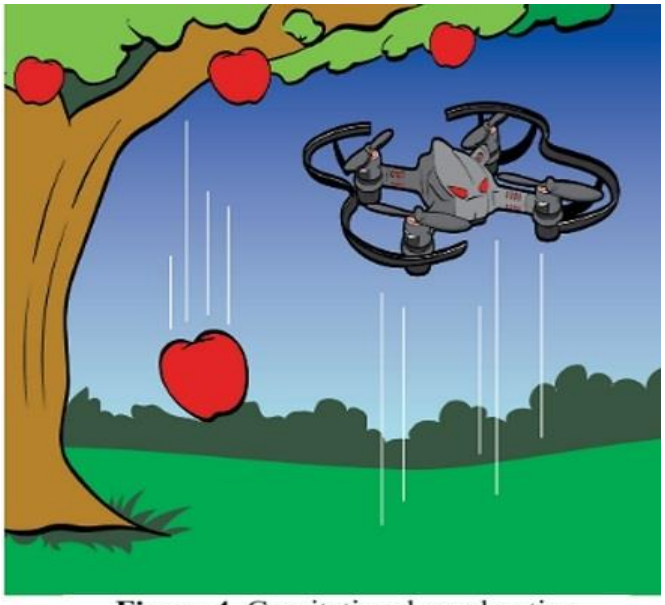


Figure 4. Gravitational acceleration



Figure 5. Which of the missions can the drone perform

Which of the following missions can be performed by a flying drone (fig. 6)?
I can...



Figure 6. Which of the missions can the drone perform

Which of the following missions can be performed by a flying drone (fig. 7)?

I can...



Figure 7. Which of the missions can the drone perform

Here are the correct answers, with some additional explanations:

Drones can:

– to show farmers crops that have not grown enough;

– fly over vast agricultural areas, observing the crops up close, more efficiently, faster than the farmer can do;

– to help save endangered species;

– follow groups of animals, because they can fly closer to them than a human and far enough, so as not to scare them (fig. 8);

– to extinguish forest fires;

– detect fires and film with special cameras through the smoke, providing firefighters with relevant information about the direction and intensity of the fire;

– to film at a height.



Figure 8. Red panda

Without drones, much more time would be required for these shoots and much more equipment.

Drones can:

– to help build a very high block;

– raise cables to great heights that they can weave into the structure of the building;

– to take photos;

– to save lives: they sometimes manage to deliver medical equipment in a shorter time than an ambulance.

What missions would you give to a drone (fig. 9)?

Be creative!



Figure 9. What missions can we give a drone

After these activities, the teaching staff will propose to the students to draw a drone, an unprecedented, funny... original one.

Such approaches can also be carried out in other subjects of general education.

Those interested in the methodology of implementing drones in general education, according to existing disciplinary curricula, are recommended the source [1], which includes:

– Implementation of drones in primary education from a STEAM perspective [1, p. 41 – 53].

– Implementation of drones in secondary education from a STEAM perspective [1, p. 54 – 69].

– Implementation of drones in high school education from a STEAM perspective [1, p. 70 – 91].

Conclusions

Both innovations in the field of information technologies and smart devices can be successfully used by teachers to teach exact subjects. This allows us to more effectively train students in the ability to apply new inventions to make future activities more efficient.

Increasingly, these days, unmanned aerial vehicles are widely used in various branches of the world economy. Such vehicles can be implemented in the teaching of the exact subjects from the perspective of the STEAM approach, integrating the acquired knowledge. At the same time, we can achieve, within the lessons, learning based on non-standard problems.

Within the exact disciplines, students get to know different geometric figures and bodies, perform practical activities related to calculating lengths and perimeters [4, pp. 274 – 276], calculating areas, get to know rectilinear and curvilinear motion, a particular case of the last one being circular motion [5, p. 14], I get to know the classification and properties of electromagnetic waves, etc. [6, p. 83]. Using the drones, the students will have the opportunity to fly over the air space to view the school yard from a height and observe the shapes of the geometric bodies of the elements in the school yard. They will have the opportunity to analyze the drone to observe and discover the relationships between the shape, the distance of the placement of the engines and the propellers for the most efficient operation.

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