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UTILIZAREA DRONELOR ÎN PROCESELE EDUCAȚIONALE

THE USE OF DRONES IN EDUCATIONAL PROCESSES

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Abstract. The development of information and communication technologies is gradually replacing traditional teaching in a training context. Widely used, these technologies make teaching and learning successful and interesting for both trainees and trainers. Given the rapid evolution of new technologies, the use of drones in education has a very high impact, especially in science, technology, engineering and mathematics (STEAM). The integration of ICT in teaching and learning processes requires trainers to acquire a certain level of different skills to cope with all the challenges associated with their integration in educational processes. Drones called flying robots, including unmanned aerial vehicles (UAV) that can travel thousands of kilometers, or fly in confined spaces, have very recently expanded in educational environments, attracting significant attention due to their potential to support learning, and are considered as an alternative educational strategy for innovating learning environments and contexts.
Key words: drones; flying drones; unmanned aerial vehicles; education; trainable; STEAM.

According to the European Commission, by 2050, the drone industry could create around 1500000 jobs in the European Union, spread among manufacturers, operators and other actors providing drone-enabling technologies such as flight control, sensors and energy. For the providers of educational activities and continuing vocational training the use of drones in activities allows to ensure a qualitative education process. Integrating UAVs into vocational training allows organizations to diversify their educational offer and adhere to modern educational trends. By including innovative courses that use cutting-edge technologies, the relevance of training in the face of changes in the labor market is ensured.

As regards the selection of appropriate learning models, we note that there is a tendency to use motivational models, as well as individualized and active learning, collaboration and communication.

In educational processes it is necessary to be specific in the choice of drone to produce the required results. Depending on the environment of use, the nature of the task and the age of the learners, an appropriate selection is necessary to improve learning outcomes [1, 2, 3].

Selecting the type of drone refers to choosing the appropriate model according to the environment that would be used and the task being performed. In educational activities the trainer has to take into account the specificity of the drone, as not every type of drone is suitable for every educational activity. In terms of usability, drones are divided into the following categories:

- Unmanned Aerial Vehicle (UAV).
- Unmanned Surface Vehicle (USV).
- Unmanned Underwater Vehicle (UUV).
- Unmanned Ground Vehicle (UGV).
- High altitude pseudo satellites (HAPS) [4].

Depending on the number of engines and their power, drones can be classified into tricopters, quadcopters, hexacopters, octocopters, etc.

✓ The tricopter is a helicopter-like drone, which has three rotors and servo-driven propulsion units1;

✓ Quadcopter is a flying machine that has four rotors/propellers. A quadcopter is stabilized using

different technologies, but the main stabilizers are gyroscopes;

✓ Hexacopters are remote-controlled flying devices that have six rotors/propellers. The hexacopter is a type of technologically advanced drone characterized by good maneuverability;

✓ Octocopters have eight engines and propellers. These drones have high traveling speed, high safety and stability and can fly at extreme heights, even in adverse weather conditions.

Regardless of the type of drone, their most important characteristics are generally the following: maximum operating distance; flight/travel time; flight/travel speed; connectivity; navigation system used; type and number of sensors; on-board GPS system; operating frequency; weight.

Other drone performance characteristics are as follows:

✓ availability to mount devices of different types, sizes and weights (cameras, video cameras, infrared cameras, radars, etc.);

✓ the ability to return independently to the take-off point (come-home option);

✓ the ability to remain in a given position (position hold);

✓ the ability to remain at a fixed altitude (elevation hold);

✓ small size - they are easy to maneuver and can pass through tight spaces;

✓ methods of data transmission: via radio waves, via the Internet, data coming on PCs, tablets or smartphones;

✓ operating range at which the battery can be charged from photovoltaic panels;

✓ shock resistance, so it can operate regardless of weather conditions.

Safety refers to all the factors that should be prepared and analyzed before, and during the use of drones to eliminate injury or destruction of property. Finally, the knowledge of both the trainer and the trainees is fundamental to ensure knowledge transfer and the safety of the whole process.

The need for social relationships or the development of self-esteem plays an important role in motivating the trainee to engage emotionally and intellectually in an educational process. According to Maslow's theory, the need for learning and participation in educational programs stems from different factors, such as meeting the need for security (finding a job), developing social relationships and strengthening self-image or the need for self-actualization.

Drones have significant potential in education, with the ability to transform how learners learn and how activities are delivered. From exploring the environment to developing technical and creative skills, drones can enrich the educational experience in many ways. If used correctly, drones can become a valuable teaching tool, stimulating active learning, developing the technical and creative skills of formables and contributing to a deeper understanding of the world around them.

The use of drones in educational processes is an innovative and exciting approach that can transform the way learners learn and interact with different concepts. Drone technology can add a practical and interactive element to theoretical learning, facilitating a wide range of educational activities. The humanistic approach in education is based on a number of fundamental premises and values that guide educational activity. Here are some of the key premises of the humanist approach in education:

1) Respect for the individual: the humanist approach emphasizes respect for the uniqueness and dignity of each formative. Each individual is considered to have an individual potential for development and learning, and the role of education is to facilitate this development in a respectful and empathetic way.

2) Formative-centered learning: Instead of focusing solely on teaching content, the humanistic approach puts the learner at the center of the educational process. It recognizes that learning is more effective when it is personalized to take into account the needs, interests and learning pace of each subject.

3) Experiential learning: The humanistic approach promotes learning based on experience and active involvement. Learners learn best when they are involved in hands-on activities that allow them to explore, experiment and understand topics in a concrete way.

4) Belief in human potential: The humanistic approach believes that people have the capacity to develop their potential and achieve their goals. It encourages learners to take responsibility for their own learning and development.

5) Emotion and affectivity: The humanistic approach recognizes the importance of emotions and affectivity in the learning process. Learners are seen as complex human beings and their emotional and social aspects are taken into account in the educational process.

6) Fostering positive relationships: The humanistic approach promotes positive relationships between trainers and trainees. These relationships are based on trust, empathy and open communication, creating an environment where trainees feel safe to express their ideas and develop their potential.

7) Authentic assessment: Within the humanistic approach, assessment focuses not only on knowledge and grades, but also on the overall development of the trainees, the progress of each individual. Evaluation focuses on the estimation of competences and skills, on the development of each individual [5].

This humanistic approach of using drones in educational processes demonstrates the innovative character of these processes. In the following we list some ways in which drones can be integrated into educational processes [4]:

Geography and environmental studies

- Mapping and topographic maps: trainees can use drones to create detailed maps of a specific geographical area or region. This can help in understanding topography, geological scales and processes, climate change and its effects on the environment.
- Monitoring the environment: Drones are used to collect data about natural environments (forests, rivers, mountains) and can provide a concrete example of how technology can be used to protect and monitor the environment; to monitor natural habitats as well as to track animal migration or observe weather phenomena. Through drones they can learn about pollution, for example by monitoring forests, rivers or urban areas using drones equipped with cameras to analyze the impact of human activities on the environment. Drones can help collect data for research on biodiversity, sustainable agriculture and conservation of natural resources.

Natural sciences and physics

- Aerodynamics studies: Drones are excellent examples of the use of physics principles such as aerodynamics, levitation forces and object motion. It is possible to analyze how the different components of the drone interact to allow it to fly.
- Applied physics experiments: pupils can learn about the laws of motion, kinetic energy and carry out experiments to measure the drone's speed, altitude or flight time;
- Using drones can help students understand complex engineering, programming and robotics concepts. In a technology course, students can learn how to build and program drones, gaining useful STEM (Science, Technology, Engineering and Math) skills.

Math

- Calculating distance and angles: Using drones, students can learn to apply mathematical formulas to calculate the distance traveled by drones or to measure angles and altitudes during flights.
- Data Simulations: Data collected by the drones, such as GPS coordinates and other information, can be used to create graphs and analyze statistics, giving students a hands-on approach to mathematical theory, calculating distances, speeds, and altitude.

Technology and Engineering

- Building and Design Projects: Trainees can learn how to design and build drones, engineering and technology studies. This process can include learning about electrical circuits, programming, sensors and mechanical components.
- Programming and Automation: Drones are controlled by software, which means that students can learn programming and how to create algorithms to make drones perform automated tasks or follow predefined paths.

Arts Education

- Visual and cinematic projects: Drones can be used for filming, aerial photography or in film productions, offering a new perspective on visual art. The trainers can learn filming techniques and create their own visual projects. Drones can be used to explore new frontiers of visual art, enabling the creation of films, aerial photography or organize video art performances using drones. This enables creative thinking, combining technology with artistic expression.
- Creative interactivity: Drones can be used to create interactive art installations or explore ways to express visual ideas from the air.

History and Archaeology

- Exploring historical sites: Drones can be used to study and document inaccessible or dangerous historical or archaeological sites, and students can learn about archaeological research processes through aerial imagery.
- Virtual reconstruction: Data collected by drones can be used to create 3D reconstructions of historical monuments or artifacts.

Physical and Sports Education

- Athlete training: Drones can be used to analyze athletes' movements and help improve technique by capturing images from different angles.
- Events and competitions: Students can organize drone competitions, which not only develop their technical skills, but also foster team spirit and healthy competition.
- Drones can be used to analyze sports technique and track performance in different sports: For example, in physical education, drones can film football or basketball games, and students can analyze movements and tactics using the footage. This kind of visual feedback can help improve sports performance.

Security and Ethics

- Discussing the ethics of technology: The use of drones in education can provide opportunities to discuss the impact of technology on privacy and the legal regulations related to drone flights, such as flight permits or restrictions in certain areas.

Educational simulations and games

Drones can be used to create simulations or interactive educational games

- Participate in drone competitions or races involving route planning and flight scheduling, developing problem-solving and decision-making skills.
- Drones can also be used to create interactive scenarios for learning history, science or math concepts.

Developing leadership and collaboration skills. Operating drones in teams can foster leadership, collaboration and coordination skills. Learners can work in groups to plan flights, understand strategies and solve technical problems, developing teamwork skills. In addition, they can learn about the ethics and regulations surrounding drone use, such as privacy and flight safety.

Benefits of using drones in education:

- Improved active learning skills: Drones allow students to actively participate in the learning process through experimentation and direct interaction with technology.
- Stimulate creativity: Students can learn through creativity and innovation, developing problem-

solving skills.

- Enrich the learning experience: Drones offer a hands-on learning method, combining theory with application in a real and engaging way.

Challenges

Despite the advantages, implementing drones in education can also face some challenges:

- Costs: purchasing drones and the necessary equipment is expensive.
- Legal regulations: there are legislative regulations on the use of drones, especially in urban areas or near schools, which need to be respected.
- Teacher training: The people using drones need to be properly trained to use drones for educational purposes and to properly manage these types of activities.

In conclusion, integrating drones in education can enrich the learning experience, develop technical skills and stimulate creativity and critical thinking in students. Their use for educational purposes is an important step towards training a new generation of young people who are ready to face the technological challenges of the future.

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