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SYNERGY BETWEEN SOCIAL ASSISTANCE AND DRONE IMPLEMENTATION IN EDUCATION FOR SUSTAINABLE DEVELOPMENT IN URBAN AND RURAL AREAS

Drones can be implemented in both rural and urban environments in processes such as: parcel delivery, traffic flow management, identification of infrastructure problems; solving ecological, epidemiological, medical, safety, and other socio-economic issues.

The use of drones in education and social assistance must be carried out with increased responsibility and caution, protecting personal data without affecting people's rights and freedoms.

Drones can be used in social assistance and social policy in urban and rural areas in a variety of ways. Here are some examples:

1. Traffic and road safety monitoring: Drones can be used to monitor traffic and help manage circulation in crowded areas. They can also be used to monitor road safety and prevent accidents.
2. Delivery of food and medicine: Drones can be used to deliver food and medicine to elderly or disabled people who cannot leave their homes or do not have access to a pharmacy.
3. Environmental monitoring: Drones can be used to monitor air quality, noise

levels, and other environmental factors that can affect the health of community members.

4. Agricultural activity monitoring: Drones can be used to monitor agricultural crops and help manage irrigation and other aspects of agriculture.
5. Research and development: Drones can be used to collect data and information for the development of social policies and social assistance programs.

In recent years, we have witnessed an increase in the use of drones in various fields, including education and social assistance. The synergy between these two fields can bring significant benefits for sustainable development in urban and rural areas. In a world where information technologies are developing very rapidly and artificial intelligence and robotics are being implemented in almost all socio-economic fields, students need to be able to design and guide a robot with artificial intelligence from school.

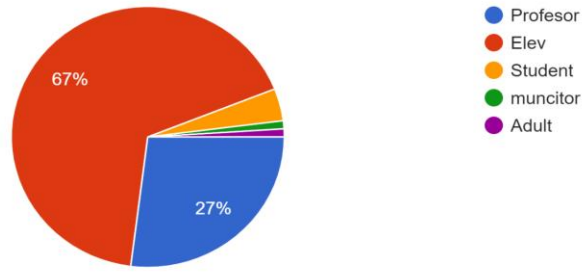
Every teacher realizes that students need the necessary skills in science, technology, engineering, arts, mathematics, and linguistics.

Many existing professions will disappear, and new professions will emerge, so students must be prepared for the challenges of the future.

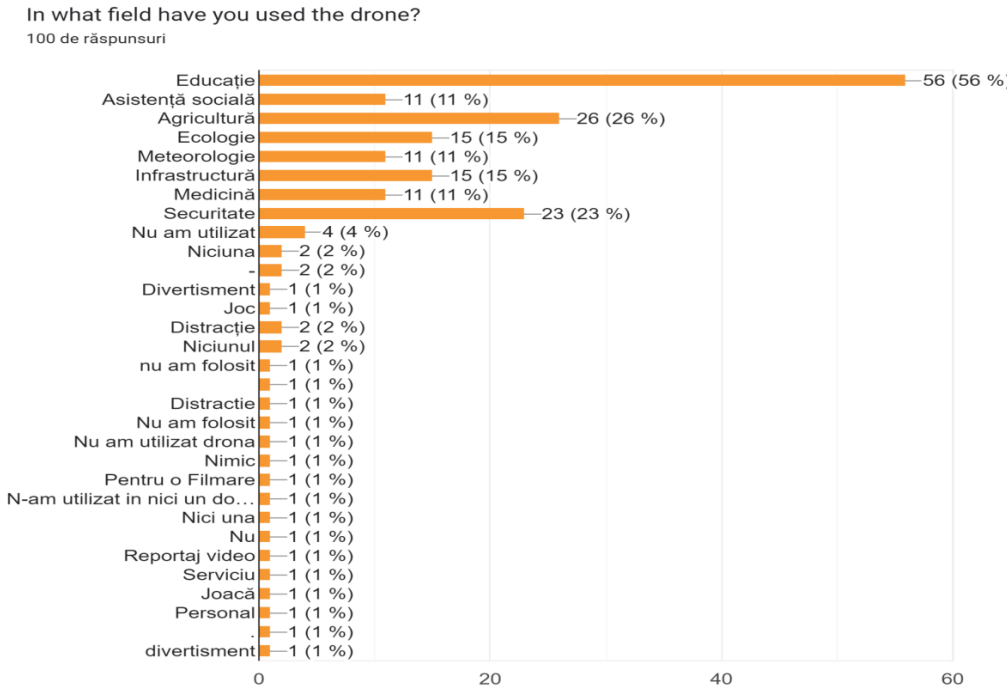
In the Republic of Moldova, drones are already being used in agriculture, security, entertainment, and education.[7, 8, 9, 10, 11, 12]

In order to identify the optimal way to use drones in school subjects, especially within the STEAM concept, and to evaluate the impact of their use on student performance and the learning process, we conducted a study to identify the advantages and challenges of using drones in education during the learning process, as well as to identify the development perspectives of using drones in future education. We conducted a sociological survey and experimented with the implementation of drones at two levels of instruction in teaching computer science. During the experiment, we used the experimental, observational, and action research models.

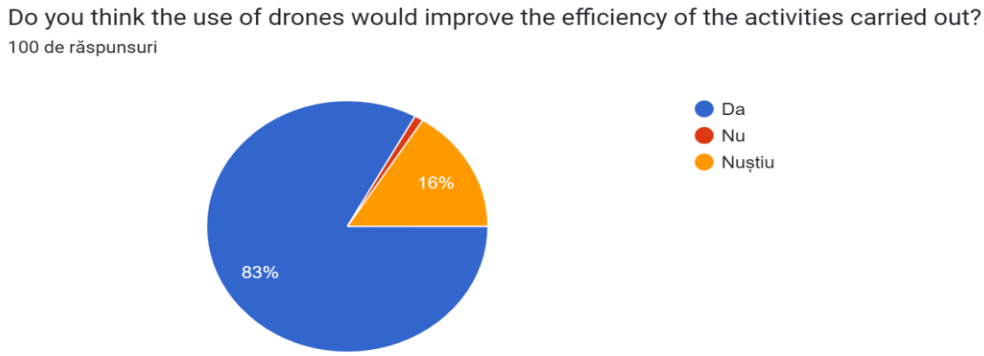
As a result of a sociological survey involving residents of the Republic of Moldova, we obtained the following results:



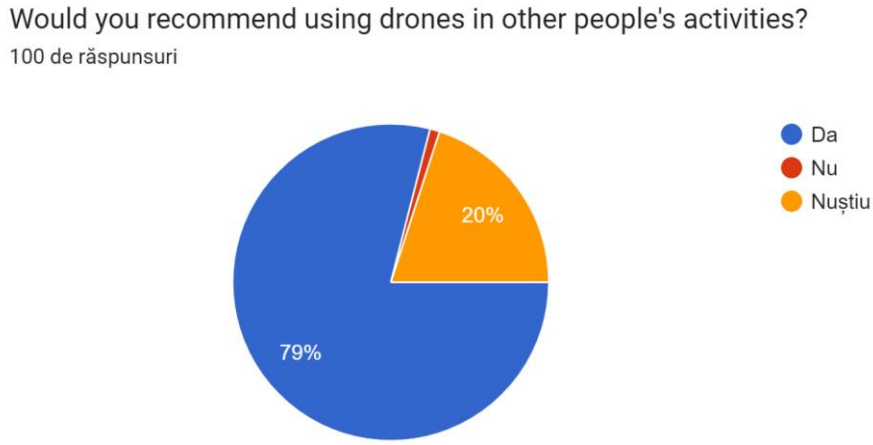
To the question: "In which field have you used the drone?" we received the following responses: from which we observe that the majority would use the drone in the field of: Education (56%), Agriculture (26%), Security (23%), Infrastructure (15%), Ecology (15%), Medicine (11%), as well as other fields**.**



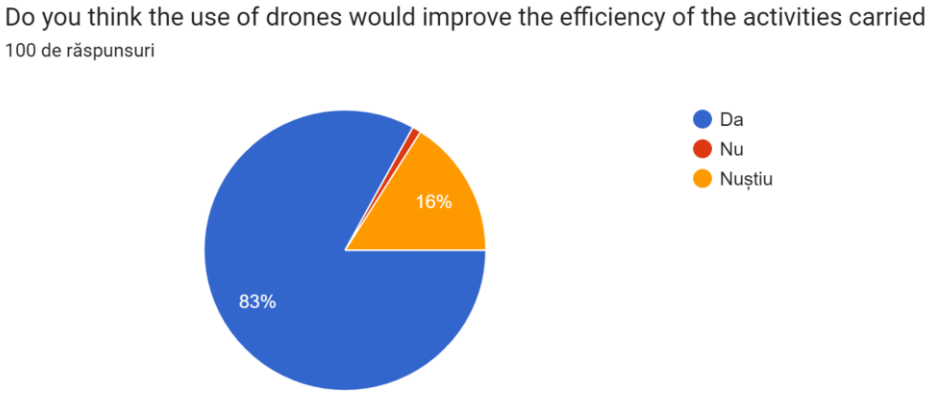
To the question "Do you believe that the use of drones would improve the efficiency of the activities carried out?" the majority responded affirmatively (83%).



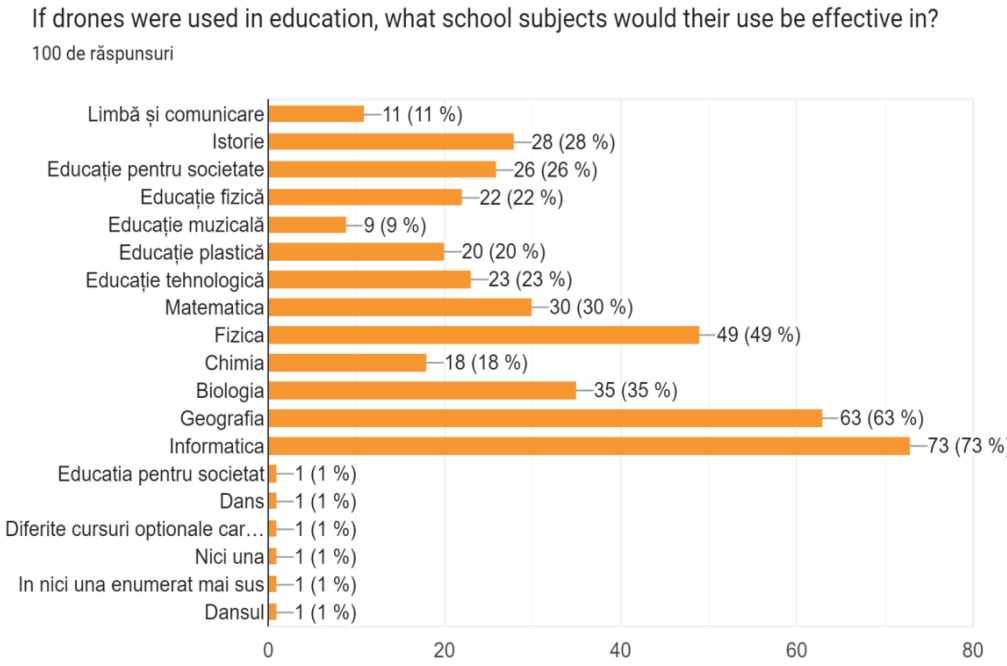
To the question "Would you recommend the use of drones in the activities of other people?" the majority responded affirmatively (79%).



To the question "Do you believe that the use of drones should be encouraged in various professional and personal fields?" the majority also responded affirmatively (83%).

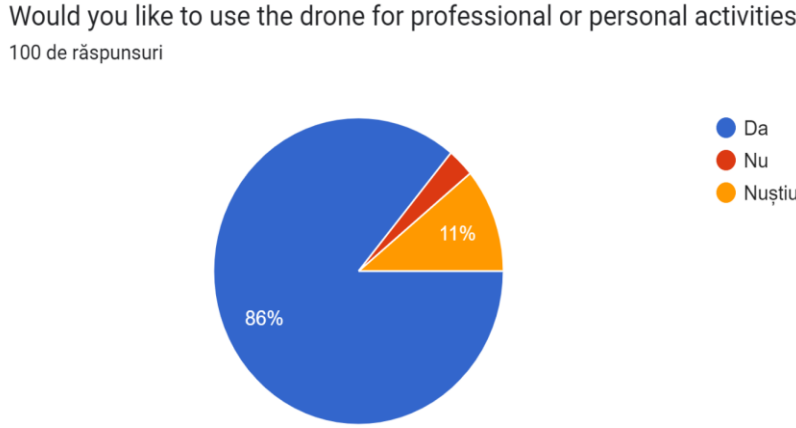


To the question "If drones were used in education, in which school subjects would their use be effective?" we received the following Top 10 ranking:

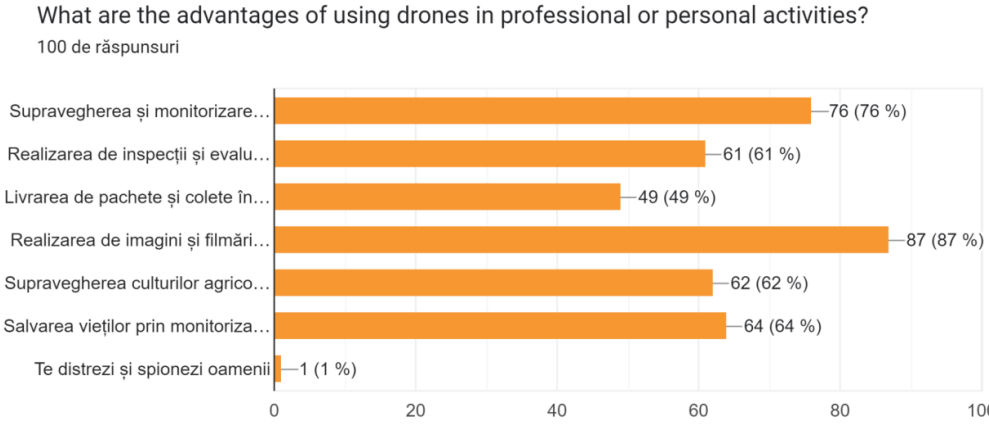


1. Informatics
2. Geography
3. Physics
4. Biology
5. Mathematics
6. History
7. Education for Society
8. Technological Education
9. Physical Education
10. Others

To the question "Would you like to use a drone in your professional or personal activities?" the majority responded affirmatively (86%).



To the question "What are the advantages of using drones in professional or personal activities?" we observe that the majority of the population would use a drone for:



1. Taking aerial images and videos for various projects, including in advertising, film, or tourism (87%).
2. Surveillance and monitoring of hard-to-reach or dangerous areas, such as radiation zones or explosion risk areas (76%).
3. Saving lives by monitoring emergency situations and helping to find missing persons (64%).
4. Monitoring agricultural crops and forest lands to identify problems and make better management decisions (62%).
5. Conducting inspections and evaluations of buildings, bridges, pipelines, or other tall structures without the need for costly and dangerous equipment for people (61%).
6. Delivering packages and parcels in a shorter time and at lower costs than usual (49%).

Despite the fact that the use of drones has many benefits or advantages, they also have a number of disadvantages. To the question "What are the disadvantages of using drones in professional or personal activities?" we have a series of negative statements or rather disadvantages such as:

- Like any other machine, it is expensive, and its production can be harmful to the environment. Also, their efficiency is not known.
- They can lead to the death of birds.
- Price.
- Privacy.
- They are fragile.
- Spying on personal life.
- Expensive, limited energy time.
- Quick detection, price.
- Hard to manoeuvre.
- The field of drone use still raises questions related to safety, reliability, and regulation.
- The drone is quite an expensive tool that not everyone can afford.
- Drones are machines that could break down due to environmental factors.
- They can malfunction, and they do not have a long-term warranty.
- Security and privacy: There is a risk that drones could be used unauthorized to obtain confidential information or to disrupt normal activities. This can raise security issues in various fields, including business, government, and the military.
- The use of drones deprives young people of the opportunity to admire the beauty of nature independently.
- Privacy concerns, as drones can be used to spy on people or invade their privacy.
- Drones can be hard to control, and there is always the risk that they will crash or malfunction. They can create inconveniences for people, and the obtained video can be used for illegal purposes or to humiliate a person.

The use of drones in education can bring numerous advantages for both students and teachers. [1, 2, 3, 4, 5, 6] Firstly, they can be used to stimulate students' interest in science and technology through interactive activities and practical experiments. Additionally, drones can be used to improve students' understanding of complex concepts, such as geography or physics, through aerial images and videos.

Moreover, drones can also be used for practical purposes, such as mapping land or monitoring the environment. These activities can help students better understand the importance of protecting the environment and acquire practical skills that will help them in their future careers.

Furthermore, the use of drones in education can also be beneficial for teachers, as they can be used to improve the quality of teaching and provide a more interactive and engaging educational experience for students.

In computer science classes, I conducted pedagogical research at two levels, in the 9th and 10th grades, studying specialized literature both from the country and abroad. [12-33] At the 9th grade level, in the module "Implementation of algorithms in graphic-interactive programming environments," I conducted pedagogical research with the aim of demonstrating the hypothesis that with the help of drone implementation in the educational process, students will achieve better results in their studies.

The implementation of drones was carried out in the 9th grade "A" (Group 1) with a number of 26 students, while the parallel group where drones were not used, the 9th grade "B" (Group 2), also had 26 students.

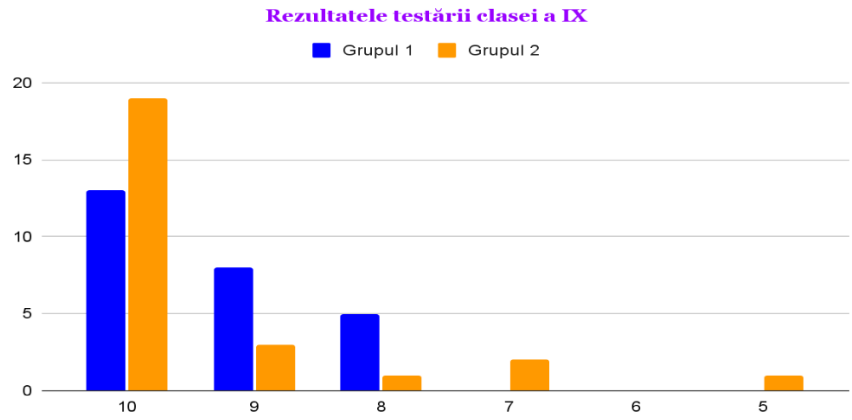


Figure 1: Test Results of 9th Grade Students

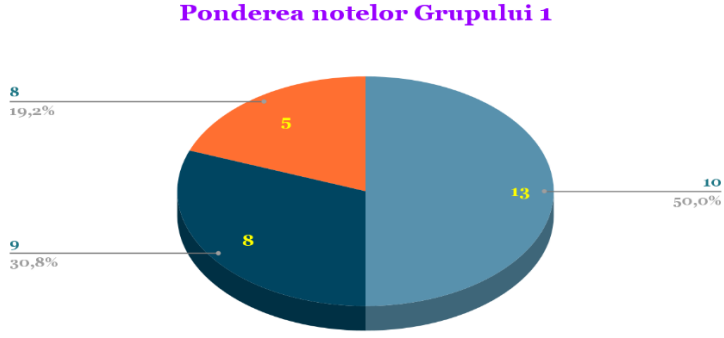


Figure 2: Weight of Grades of 9th Grade Students Group 1

From Figure 2, we observe that the weight of the grades is as follows:

- "10" is 50%;
- "9" is 30.8%;
- "8" is 19.2%.

For Group 2, we obtained the following weight:

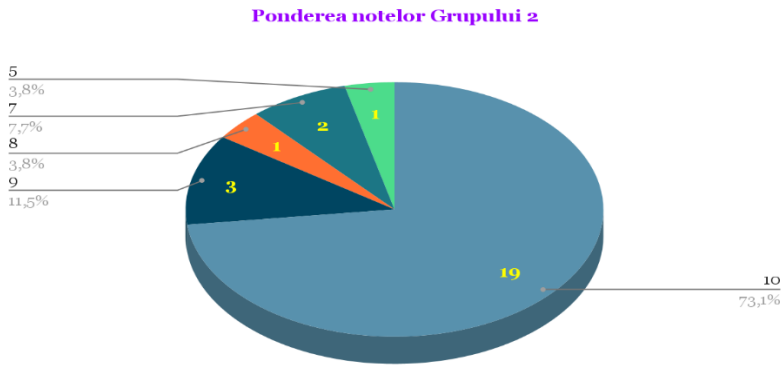


Figure 3: Weight of Grades of 9th Grade Students Group 2

From Figure 3, we observe that the weight of the grades is as follows:

- "10" is 73.1%;
- "9" is 11.5%;
- "8" is 3.8%;
- "7" is 15.6%.

From Figures 2 and 3, the weight of the grades "10", "9", and "8" have the highest values.

For data analysis, we used the Student's t-test, which is used to measure the difference between exactly two means. Its focus is on the same numerical data variable, rather than on counts or correlations between multiple variables. If we take the mean of a sample of measurements, t-tests are the most commonly used method to evaluate that data. It is particularly useful for small samples of fewer than 30 observations. The two-sample t-test compares two data sets to see if their means are statistically different. This is different from a one-sample t-test, which compares your sample mean to a proposed theoretical value.

The most general formula for a t-test consists of two means (M1 and M2) and the overall standard error (SE) of the two samples:

$$t = \frac{M_1 - M_2}{SE}$$

As a result of the evaluation, we obtained the following results:

No.	Group 1	Group 2
1	10	10
2	10	10
3	10	10
4	10	10
5	10	10
6	10	10
7	10	10
8	10	10
9	10	10
10	10	10
11	10	10
12	10	10
13	10	10
14	9	10
15	9	10
16	9	10
17	9	10
18	9	10
19	9	10
20	9	9
21	9	9
22	8	9
23	8	8
24	8	7
25	8	7
26	8	5

P-value and statistical significance:

The two-tailed p-value is equal to 0.5816. According to conventional criteria, this difference is considered to be not statistically significant.

Confidence interval:

The mean of Group 1 minus Group 2 is equal to -0.15
95% confidence interval of this difference: from -0.71 to 0.40

Intermediate values used in calculations:

t = 0.5547
df = 50
standard error of difference = 0.277

Data obtained from processing:

	Group 1	Group 2
Mean	9,31	9,46
SD (Standard Deviation)	0,79	1,17
SEM (Standard Error of the Mean)	0,15	0,23
N	26	26

Based on these results, we can conclude that the hypothesis was not confirmed at the 9th-grade level. Not only students who use programmable smart devices achieve good performance, but also those without programmable devices can obtain good results. However, those who implemented programmable smart devices had a unique experience.

At the 10th-grade level, in the module "The Concept of Action. Instructions of a High-Level Programming Language," I conducted pedagogical research with the aim of demonstrating the hypothesis that with the help of drone implementation in the educational process, students will achieve better results in their studies.

The implementation of drones was conducted in the 10th grade "B" (Group 1) with 26 students, while the parallel group, the 10th grade "A" (Group 2), where drones were not used, had 23 students.

As a result of the evaluation, we obtained the following results:

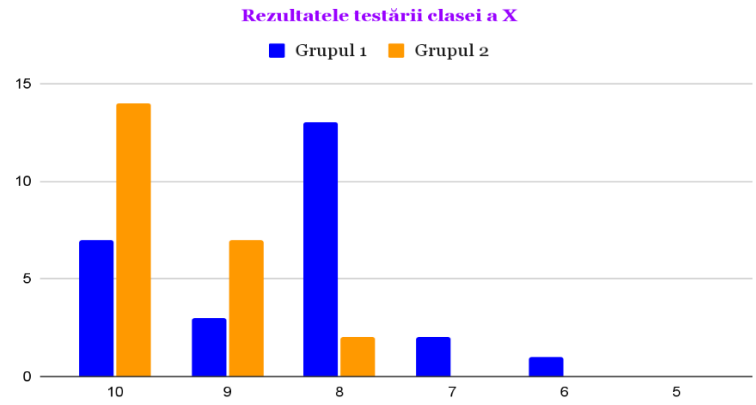


Figure 4: Test Results of 10th Grade Students

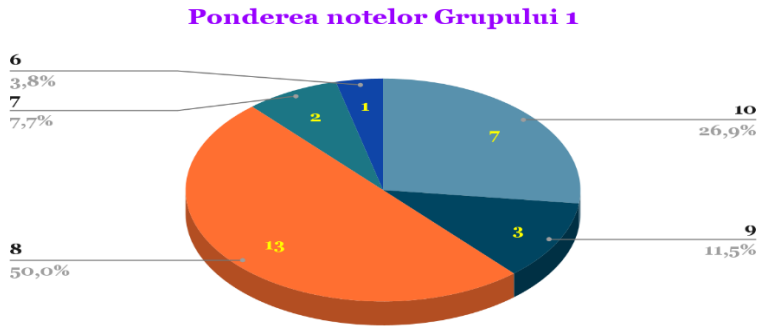


Figure 5: Weight of Grades of 10th Grade Students Group 1

From Figure 5, we observe that the weight of the grades is as follows:

- "10" is 26.9%;
- "9" is 11.5%;
- "8" is 50%;
- "7" is 7.7%.

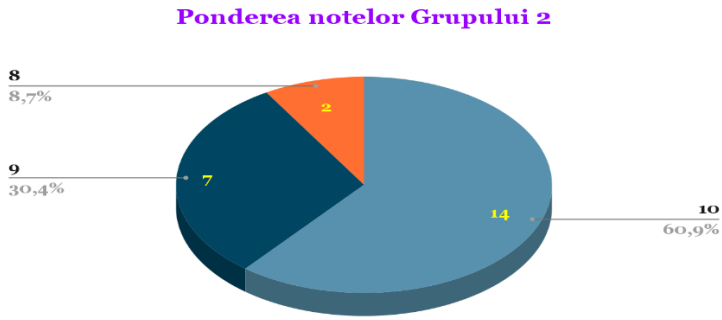


Figure 6: Weight of Grades of 10th Grade Students Group 2

From Figure 6, we observe that the weight of the grades is as follows:

- "10" is 60.9%;
- "9" is 30.4%;
- "8" is 8.7%.

From Figures 5 and 6, the weight of the grades "10", "9", and "8" have the highest values.

For the data analysis of the 10th grade, we also used the Student's t-test, which is used to measure the difference between exactly two means.

No.	Group 1(X-A)	Group 2 (X-B)
1	10	10
2	10	10
3	10	10
4	10	10
5	10	10
6	10	10
7	10	10
8	9	10
9	9	10
10	9	10
11	8	10
12	8	10
13	8	10
14	8	10
15	8	9
16	8	9
17	8	9
18	8	9
19	8	9
20	8	9
21	8	9
22	8	8
23	8	8
24	7	
25	7	
26	6	

p-value and statistical significance:

The two-tailed p-value is equal to 0.0035. According to conventional criteria, this difference is considered to be very statistically significant.

Confidence interval:

The mean of Group 1 minus Group 2 is equal to -1.21

95% confidence interval of this difference: from -2.01 to -0.42

Intermediate values used in calculations:

t = 3.0773

df = 47

standard error of difference = 0.395

Data obtained from processing:

	Group 1	Group 2
Mean	8,31	9,52
SD (Standard Deviation)	1,78	0,67
SEM (Standard Error of the Mean)	0,35	0,14
N	26	23

In light of these results, we can conclude that the hypothesis has been confirmed at the level of class X-B because students who use programmable smart devices achieve not only in programming but also in implementing the STEAM concept by using the knowledge acquired in mathematics, physics, biology, arts, and other school subjects. Students without programmable devices can achieve good results, but not as good as in the case of integrating the STEAM concept during classes when students experience various situations in order to solve problems from everyday life or provide social assistance services.

Social assistance is a field that provides services and support for vulnerable or marginalized individuals in society. These services often include mental and physical health care, counselling, and financial support.

Regarding sustainable development, social assistance can play an important role in promoting social inclusion, human rights, and economic equity in local communities. Through social assistance programs, community needs can be identified and solutions tailored to them can be developed, thus contributing to the sustainable growth of communities.

Drones can be used in education to enhance the learning experience and improve access to information. They can be used to collect data and information from hard-to-reach or dangerous areas, as well as to create 3D models of terrains or buildings.

Regarding sustainable development, drones can be used to assess the impact of climate change on the environment, to identify areas with illegal deforestation or pollution, and to monitor urban and rural development. Through these means, students can learn about environmental issues and contribute to developing sustainable solutions for them.

The synergy between social assistance and the implementation of drones in education can bring significant benefits for sustainable development in urban and rural areas. Through social assistance programs, community needs can be identified and tailored solutions can be developed, while drones can collect the necessary data and information for developing these solutions.

For example, drones can be used to identify areas with illegal deforestation or pollution, and then social assistance programs can develop solutions to com-

bat these problems. Additionally, students can learn about environmental issues through the use of drones and contribute to developing sustainable solutions for them.

Benefits of Synergy: The synergy between social assistance and the implementation of drones in education can bring a series of significant benefits for sustainable development in urban and rural areas. These benefits include increased access to information and resources, promotion of social inclusion, identification and resolution of environmental problems, and improvement of the quality of life in local communities.

Moreover, through this synergy, long-term sustainable development can be promoted, taking into account the current and future needs of communities. Thus, it can contribute to increasing economic and social equity in these areas, as well as protecting the environment.

In the Republic of Moldova, drones are used in various sectors of the national economy. Regarding citizen security, drones are used to scan the land surface from above and keep the border area safe. In the forestry sector, drones are used to scan forested areas to combat illegal deforestation and to plant seeds to expand forest areas. In agriculture, some entrepreneurs use drones to monitor agricultural land for safety purposes as well as for irrigation or spraying crops. In education, curricula have been developed for middle and high school cycles, "Programming and Piloting Drones," as an optional course in the school curriculum to equip students with skills in designing, developing, programming, guiding, maintaining, and using unmanned aerial vehicles.[9,10]

In conclusion, drones can be a valuable tool in social assistance and social policy in urban and rural areas, helping to improve safety, deliver food and medicine, monitor the environment and agricultural activity, and research and develop social policy.

The synergy between social assistance and the implementation of drones in education can bring significant benefits for sustainable development in urban and rural areas. Through these two fields, community needs can be identified and tailored solutions can be developed, thus contributing to the sustainable growth of communities.

It is important to continue exploring this synergy and developing new ways to use drones and social assistance to promote long-term sustainable development. Together, we can contribute to building a more sustainable and equitable future for all residents of urban and rural areas.

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Streszczenie

Ponieważ jutro nie będzie takie, jakie znamy dzisiaj, a technologie informacyjne rozwijają się z prędkością światła, konieczne jest inwestowanie we wdrażanie dronów w programach szkolnych, aby zwiększyć skuteczność polityk społecznych i poprawić równość społeczeństwa zarówno na obszarach wiejskich, jak i miejskich.

Słowa kluczowe: synergia, pomoc społeczna, drony, edukacja, miasto, wieś, rolnictwo, ekologia, infrastruktura.

Summary

Since tomorrow will not be as we know it today, and information technologies are developing at the speed of light, it is necessary to invest in the implementation of drones in school programs to streamline social policies and improve social equity in both rural and urban areas.

Keywords: synergy, social assistance, drones, education, urban, rural, agriculture, ecology, infrastructure.