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THE EDUCATIONAL FILM USED IN THE STUDY OF PLANT DEVELOPMENT ACCORDING TO THE ENVIRONMENT

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Abstract

The purpose of this research is to analyse the process of knowing the plant life cycle, achieved by students during learning activities using educational films and other means of education (study guide, posters, worksheets). This research investigated how the use of the educational film may be capitalized in the teaching activity. The study took place during the Mathematics and Environmental Exploration class, at the lesson on the life cycle of plants. The participants were second-grade students distributed in an experimental group and a control group. The two groups were involved in two tests: an initial one, before watching the film, and a post-test, after watching it. The students in the experimental group received a study guide before the activity of watching the film. After completing the test, they watched the film again and discussed its content with the teacher, using other visual materials and solving some tasks. In conclusion, the use of the study guide associated with the educational film is effective only if the students have previous knowledge about the subject they learn. It is not enough for students to watch the educational film by themselves to understand and learn. To grasp correct representations in the field of Natural Sciences and to improve the thinking skills they need to be involved in active learning activities coordinated by the teacher.

Keywords: *teaching strategies, environmental education, primary education, life cycle, study guide*

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INTRODUCTION

Nowadays, in Romania, most of the students use digital technology and multimedia products in various contexts, for leisure or learning (Crăciun & Bunoiu, 2019). Pre-university and university students spend a great part of their time resources in activities on the Internet (Dulamă, Magdaș & Osaci-Costache, 2015) and social networks (Dulamă, Vescan & Magdaș, 2016). In order to adapt the educational process to the native digital students belonging to Z generation, the teachers show interest in developing their digital skills and in valuing the opportunities offered by the information technology for the teaching process of acquiring knowledge in different areas (Magdaș et al., 2018; Magdaș, Vereș & Dulamă, 2019).

Teachers are increasingly using various videos (instructional videos, fiction films, and others) in their lessons, for educational purposes, to increase the level of knowledge or to clarify concepts (Ilovan et al., 2015; Wijnker et al., 2019). In the digital textbooks developed in recent years in Romania for the studying of *Mathematics and Environmental Exploration* in primary education, interactive learning activities based on dynamic multimedia products were created (Buzilă et al., 2017; Dulamă et al., 2017; Ilovan et al., 2018; Magdaș et al., 2017a).

Although information technology is highly developed at the global and national level and students and teachers are interested in this technology, in primary education in Romania, films are scarcely used in environmental education, and therefore teaching strategies that can be associated with them to increase the efficiency of teaching and learning are little known and capitalized.

This study aims to investigate how the teaching process on the Natural Sciences class can be improved by using an educational film. The questions we intend to answer in this research are the following: What are the strategies through which we identify the most appropriate educational film for a topic? What are the criteria according to which educational films are classified? How can we effectively use an educational film in primary education, during natural science lessons?

In order to achieve the purpose and to answer the research questions, an action research was organized to test the following hypotheses:

H1. If the students use a study guide when they individually watch an educational film, then the amount of knowledge within the studied subject will increase.

H2. If students watch an educational film twice and are involved in a learning activity where its content is discussed with the teacher, using other visual materials, then their amount of knowledge reached on the studied subject will increase.

The dependent variable is the amount of the students' knowledge. The independent variable corresponding to the first hypothesis is

represented by watching the film and the questions in the study guide, and the independent variable corresponding to the second hypothesis is watching the film again and the integration of its content in a wider topic discussed with the teacher.

THEORETICAL BACKGROUND

At present, the development of technology allows easy film making (Roos & Van den Bulck, 2019), at a low cost and using devices accessible to teachers and students (Dulamă et al., 2019; Dulamă, Magdaș & Chiș, 2019). Worldwide distribution of various kinds of films is made rapidly and easily through YouTube platform, Facebook and Twitter social networks (Roos & Van den Bulck, 2019; Magdaș, Ilovan & Ursu, 2018). Different organizations, such as the National Aeronautics and Space Administration (NASA), the European Space Agency (ESA), the European Southern Observatory (ESO) and others produce videos for the general public and share them for free through social media channels (Roos & Van den Bulck, 2019).

It is confirmed there are various formats of films (educational, informative, news, scientific stories, sciences, behind the scenes, animations, animations based on data) (Roos & Van den Bulck, 2019) and that the videos have different characteristics, they differ according to the quantity and structure of information, according to the audio-visual presentation mode (Wijnker et al., 2019). Watching movies and other visual products by pre-schoolers and students is facilitated by the existence of tablets (Fridberg, Thulin & Redfors, 2018), smartphones, and other electronic devices (Rus et al., 2019), smart boards that are present in many classes (Zoltan, Magdaș & Dulamă, 2019; Magdaș, Zoltan & Dulamă, 2019).

The educational films for children are intended to provide knowledge about a particular issue (Michel, Roebers & Schneider, 2007). The use of 3D films is considered as a way to stimulate interest, teaching being more efficient because the information is received through a verbal and visual channel, and the recipients receive more information and recollect it for a longer time (Markiewicz-Patkowska et al., 2019). It was found that pre-schoolers who used emerging technologies – tablets – communicated more effectively about a natural phenomenon (the changing states of water), focused easier when solving tasks, and improved their reasoning (Fridberg, Thulin & Redfors, 2018).

Visual Technology has the ability to bring the world closer to the student (Good, 2019), being very valuable in studying distant places, objects (Dulamă, 2001, 2006, 2008), and dangerous phenomena (Dulamă, 1996, 2004, 2010; Dulamă & Roșcovan, 2007). It was observed that the students recollected best the historical or geographical facts introduced by a presenter through visual resources (maps, photographs, chronologies, graphs) (Arias-Ferrer, Egea-Vivancos & Monroy-Hernandez, 2019).

Audio-visual media are considered to be very important for the implementation of the current curriculum (Dulamă, Ilovan & Magdaș, 2017;

Magdaș et al., 2017b). In the examples from the video sequences made by the student, it was found that asking questions about certain chemical processes (fruit decomposition) contributed to the construction of cognitive schemes and had positive effects on the development of scientific skills (Solé-Llussà, Aguilar & Ibáñez, 2019).

From the analysis of more than one hundred videos posted on the ESA, ESO and NASA YouTube channels, it was found that the most popular ones were those based on animations and data representation, without explanations, with few explanations and those with a musical background. This was explained by the higher entertainment value of these videos (Roos & Van den Bulck, 2019). The videos comprising the asked questions were associated with the increase of the students' interest, while the informative ones, with authoritative speakers, were associated with the increase of the amount of self-reported knowledge (Wijnker et al., 2019).

It was also found that a large amount of information in a video, presented in a short time, can have a negative effect on understanding and learning, causing the redundancy effect (Arias-Ferrer, Egea-Vivancos & Monroy-Hernandez, 2019).

METHODS

Participants. The participants of this research are 28 second-grade students enrolled at "Gh. Ruset-Roznovanu" Highschool of Roznov, and their primary school teacher, Maria Carmen Drîngu. They were assigned in two groups: an experimental group (EG) and a control group (CG). To have two equivalent groups, the sampling was established based on the scores the students obtained in the first class. Each group consisted of three students marked only with Very Good (Vg) scores, seven students with predominantly Good (G) scores, two students with Sufficient (S) scores, and two students with Insufficient (I) scores. The research was designed and organized by the primary education teacher Ana-Simona Ilie, researcher and author of this study.

Research stages. (1) In the first stage, the initial test (Appendix A) was applied to the two groups to identify their level of knowledge on this subject.

(2) In the second stage, the students watched the film "Bean Time-Lapse - 25 Days | Soil Cross Section" (https://www.youtube.com/watch?v=w77zPAtVTuI). Unlike the students in the CG, those in the EG received a study guide (Table 1) including ten questions regarding the plot of the film. They read the questions before watching the film and they also had the opportunity to read them while watching the video. They answered questions after watching the film.

Table 1. Study guide

The study guide questions
1. Where is the bean placed?
2. At what depth in the ground (soil) is the bean seed placed?
3. What is the name of the part of the plant that develops from the bean (seed)?
4. What direction did the root of the bean (seed) begin to develop/ grow?
5. How did the root develop further?
6. What is the name of the part of the plant that grows on the surface of the ground?
7. What direction did the bean (seed) plant continue to develop?
8. How did the stem develop further?
9. What parts of the plant developed on the stem?
10. How long did it take for the plant to develop?

(3) In the third stage, test 2 was applied to both groups to determine the level of students' knowledge about the introduced subject, acquired as a result of watching the film. The students solved the two tests by themselves, receiving instructions from the teacher just on how to complete the first and last name, the calendar date and the grade. They were asked to solve only the requirements to which they know the answers, with the mention that a missing or incomplete answer would not cause them any disadvantage. After completing test 2, the 14 students in the CG, together with the primary school teacher, Drîngu Maria Carmen, left the classroom.

(4) In the fourth stage, the EG continued its learning activity, guided by the primary school teacher, Ana-Simona Ilie.

(5) In the fifth stage, test 3 was applied to the EG, to determine the level of students' knowledge about the subject introduced after the learning activity led by the teacher.

Procedure. To collect the data, the following instruments were used: the study guide, the initial test 1, test 2, and test 3. The test scores were statistically processed. The students' answers to the questions in the study guide were subjected to content (numerical) analysis. The educational film was analysed through visual methods.

The research material consisted of the educational film, the students' answers to the questions in the study guide, the solutions to the three tests.

RESULTS

1. Strategies to identify the most appropriate educational film for the topic. The following strategies were used: a. search on the Google browser by "plant life cycle/ videos" keywords; b. searching on the YouTube website by "the plant life cycle" keywords; c. asking for support from the primary school teachers from discussion groups on Facebook social media; d. asking for support from the primary school teachers from "Gh. Ruset-Roznovanu" Highschool, in Roznov, Neamț County; e. searching for educational films CDs in the library of "Gh. Ruset-Roznovanu" Highschool, in Roznov, Neamț County; f. searching for educational films CDs in the library of the Teachers Training Centre of Neamț.

2. Selection criteria for educational films. Several criteria were identified based on which the educational films were classified: a. analogue and digital film (Todoran, 2004, qtd. in Ciascai, Dulamă & Marchiș, 2007); b. by purpose: motivational film, lesson film, problem film, synthesis film (Ciascai, Dulamă & Marchiș, 2007); c. by author (films made by amateurs or professionals); d. length (short, medium, and long films); e. by shooting position (from the ground surface, by drones); f. by recipient (the general public, specialists in a field); g. by shooting speed of the frames: normal (24-25-30 FPS), accelerated (48/60 FPS), slow motion ("If a motion is filmed at > 24 FPS and it is projected at < 24 FPS, the eye will see details that a standard shooting does not provide. If the camera initially has a zoom of 24 FPS and increases to 60 FPS, the projection of 24 FPS the effect will be to slow down time. The atmosphere comes in slow motion") (http://ct-asachi.ro/e107_files/downloads/productie%20media/3.%20Tipuri%20de%20filmare.pdf)

3. The educational film presentation. The educational film presentation. The film "Bean Time-Lapse - 25 Days | Soil Cross Section" (https://www.youtube.com/watch?v=w77zPAtVTuI) lasts 3 minutes and 9 seconds. The film shows in the cross-section of the soil how the root develops from a bean seed. It is observed how the upper part of the plant (stem and leaves) grows during a period of 25 days. The shooting speed is of 17,280x (one frame every 9 minutes and 36 seconds, filmed at 30 FPS). According to the producer of the film, Gphase, this was the fourth filming attempt. During other attempts, the roots hid further away from the glass. The image sequence for this video was edited and exported with Capture One. The filmmaker offers an e-mail address for questions (gphaseforinquiries@gmail.com). The film has "The Blue Danube" by Johann Strauss as a musical background.

4. Students' outcomes at the study guide and tests. The 14 students from the EG filled in the study guide received by each one (Table 2). 22 answers were correct, 16 answers were wrong, 102 questions were left unanswered.

Table 2. Experimental group students' study guide answers

Student		Study guide question									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1		I	I	I	I	-	-	-	-	-	-
2		Vg	I	-	-	-	-	-	-	-	-
3		-	-	-	-	-	-	-	-	-	-
4		Vg	-	-	-	-	-	-	-	-	I
5		-	-	-	-	-	-	-	-	-	-
6		-	-	-	-	-	-	-	-	-	-
7		Vg	I	Vg	Vg	Vg	Vg	I	Vg	Vg	-
8		I	I	I	-	-	-	-	-	-	-
9		Vg	I	I	-	-	-	-	-	-	-
10		-	-	-	-	-	-	-	-	-	-
11		I	-	I	-	-	-	-	-	-	-
12		Vg	Vg	Vg	Vg	Vg	Vg	Vg	Vg	Vg	I
13		Vg	-	-	-	-	-	-	-	Vg	Vg
14		-	-	-	-	-	-	-	-	-	-
Total	Vg	6	1	2	2	2	2	1	2	3	1
	I	3	5	4	1	-	-	1	-	-	2
	Missing	5	8	8	11	12	12	12	12	11	11

At the applied tests, the students obtained the results presented in Tables 3, 4, 5 and Figures 1, 2 and 3. The results were expressed in scores because this is the evaluation system used in the primary school in Romania. Table 3 shows the number of grades obtained by the students of both groups (experimental and control), for each of the three items of the three administered tests.

The results obtained by the control group in test 1 (initial) were better than those obtained by the experimental group at the same test. It can be observed that, after watching the educational film, the results of the students from the two groups in test 2 did not improve, even though the students of the EG received a study guide before watching it, but without other explanations. This fact demonstrates the need for developing learning activities by a teacher's guidance. The results of the students in the EG, at test 3, demonstrate an increased level of acquired knowledge as a result of participating in the learning activities organized by the teacher after watching the film. There is an increase of 7 in the number of **Very good** scores, compared to test 1, an increase in the number of **Good** scores (with 17), a stagnation in the number of the Sufficient scores and a decrease of 7 in the number of **Insufficient** scores.

Table 3. The number of scores obtained at tests items applied to students

Experimental group					Control group	
Item	**Score**	**Test 1**	**Test 2**	**Test 3**	**Test 1**	**Test 2**
1	Vg	1	3	8	3	5
	G	5	-	-	3	-
	S	2	8	-	2	8
	I	6	3	6	6	1
2	Vg	11	1	6	12	1
	G	-	-	7	1	4
	S	-	4	1	-	3
	I	3	9	-	1	6
3	Vg	7	-	12	4	1
	G	3	9	1	7	3
	S	-	4	1	2	8
	I	4	1	-	1	2

Table 4. Students' test results

Experimental Group										Control Group						
Student no.	**Test 1**			**Test 2**			**Test 3**			**Student no**	**Test 1**			**Test 2**		
	I1	**I2**	**I3**	**I1**	**I2**	**I3**	**I1**	**I2**	**I3**		**I1**	**I2**	**I3**	**I1**	**I2**	**I3**
1	I	I	I	I	I	S	I	Vg	S	**15**	S	Vg	Vg	Vg	S	S
2	I	Vg	Vg	S	I	G	Vg	Vg	Vg	**16**	G	Vg	G	S	G	Vg
3	I	Vg	Vg	S	S	S	Vg	S	G	**17**	S	Vg	G	S	S	S
4	S	Vg	G	S	I	G	I	G	Vg	**18**	G	Vg	G	Vg	Vg	S
5	G	Vg	Vg	S	S	G	Vg	G	Vg	**19**	I	Vg	S	S	I	S
6	I	Vg	I	Vg	I	S	I	G	Vg	**20**	Vg	Vg	G	S	G	S
7	G	Vg	Vg	S	I	G	I	Vg	Vg	**21**	I	G	Vg	S	I	I
8	I	I	I	Vg	I	G	I	Vg	Vg	**22**	Vg	Vg	G	S	G	G
9	S	Vg	Vg	S	I	G	Vg	Vg	Vg	**23**	Vg	Vg	Vg	Vg	I	G
10	Vg	Vg	G	Vg	I	G	Vg	G	Vg	**24**	I	Vg	G	I	I	G
11	G	Vg	Vg	S	S	S	Vg	Vg	Vg	**25**	G	Vg	Vg	Vg	G	S
12	G	Vg	G	I	Vg	G	Vg	G	Vg	**26**	I	Vg	S	S	I	S
13	G	Vg	Vg	S	S	G	Vg	G	Vg	**27**	I	I	I	Vg	I	I
14	I	I	I	I	I	I	I	G	Vg	**28**	I	Vg	G	S	S	S

Table 5. Test results (the number of Vg, G, S and I scores from the total number of items) of the experimental and control group

	Scores											
	Vg			G			S			I		
Test	**T 1**	**T 2**	**T 3**	**T 1**	**T 2**	**T 3**	**T 1**	**T 2**	**T 3**	**T 1**	**T 2**	**T 3**
Experimental Group (EG)	**19**	**4**	**26**	**8**	**9**	**26**	**2**	**16**	**2**	**13**	**13**	**6**
Control Group (CG)	**19**	**7**	**-**	**11**	**7**	**-**	**4**	**19**	**-**	**8**	**9**	**-**
EG-CG Differences	**0**	**-3**	**26**	**-3**	**2**	**26**	**-2**	**-3**	**2**	**5**	**4**	**6**

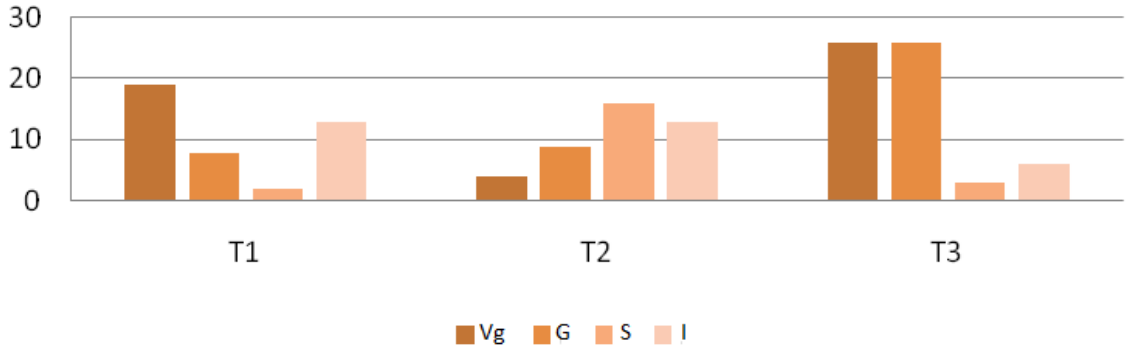


Fig. 1. The results of the experimental group in tests 1, 2 and 3

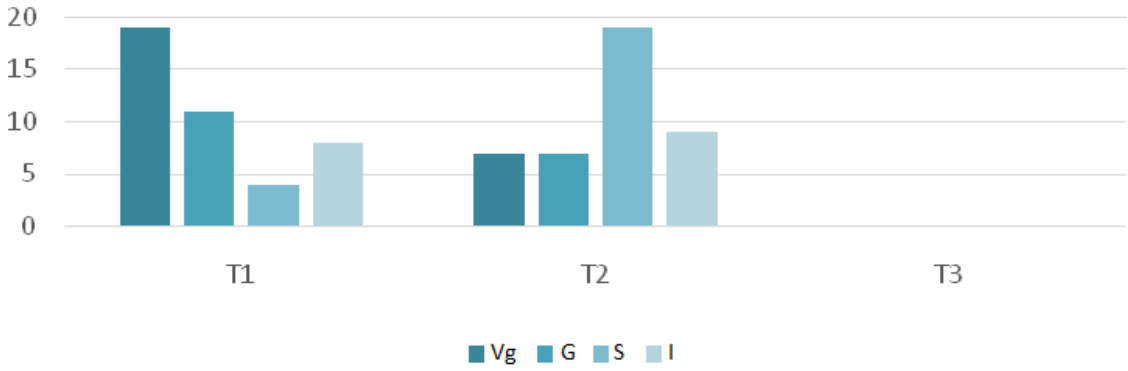


Fig. 2. The results of the control group in tests 1 and 2

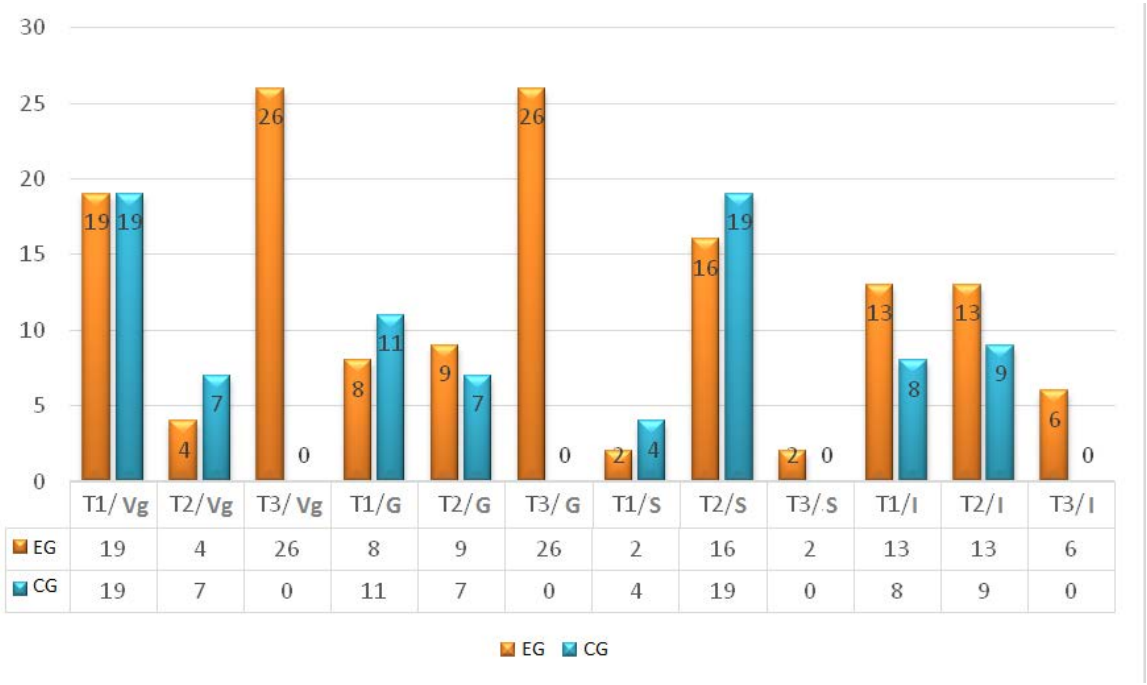


Fig. 3. The results obtained at the tests by the EG and the CG

DISCUSSION

1. The analysis of the strategies to identify the most appropriate educational film for the topic

a. *Searching on the Internet using the Google Browser.* The search was made by writing the keywords in Romanian: „ciclul de viata al plantelor”/ „ciclul de dezvoltare al plantelor” and in English “plant life cycle/ life cycle/ the cycle of plant development” videos or, from the Tools Menu- All videos- subtitles. As 7,890 video results were found, the selection of the educational film took a long time.

b. *Searching on the Internet, on the YouTube platform.* The search results indicated that most of the videos were on YouTube. So, a film was searched for on this website using the same keywords, in Romanian and English (Google/ YouTube/ Filters). The “Film” filter was applied, but no results were found. Then the “Relevance” filter was selected, finding seven results. When watching the first video, in the list of the videos popping on the right of the screen, the third film ranked there was noticed as it featured a bean root developing in the soil in cross-section. On this site, the videos listed on top are also the most watched.

c. *Requesting the support of the primary school teachers from the discussion groups on the Facebook social network.* Teachers and parents that joined this kind of group on Facebook were asked to recommend an educational film about the life cycle of plants. The received

recommendations indicated the search on YouTube platform. Thus, it can be inferred that this site is mostly used by teachers when looking for educational films. This was the only response received, but no film was posted by the respondents.

The inquired groups were: „Idei pentru clasa pregătitoare" ["Ideas for the primary school preparatory grade"], „Grupul Twinkl România" ["Twinkl Group Romania"], „Clasa a II-a" ["The second grade"], „Materiale didactice" ["Teaching materials"], „Profesori pentru învățământul primar" ["Teachers for the primary school"], „Idei didactice cu priză la educabili" ["Teaching ideas catchy for the learners"] and „Viață după ICOS ... în clasa a II-a" ["Life after ICOS... in the second grade"]. As it may be seen, there is a need for creating a group on Facebook, through which teachers could find out more about the strategies, criteria, and the efficiency of using educational films in primary school education.

d. *Requesting the support of primary school teachers from the Teaching Committee.* 15 teachers of the *Teaching Committee for primary school education*, at "Gh. Ruset-Roznovanu" Highschool, in Roznov, Neamț County, were asked what kind of educational films they used in class. They stated that they used historical films (for example, about the great Romanian rulers), artistic films and that they most often used the animation films attached to digital textbooks or curricular auxiliaries.

e. *Searching for CDs with educational films in the school library of the institution.* In the library of "Gh. Ruset-Roznovanu" Highschool, in Roznov, only animated films on the DVDs that are attached to the digital textbooks were present.

f. *Searching for educational films CDs at the Teacher Training Centre of Neamț.* Inside this organization, only animated films stored on DVDs were found.

2. The analysis of the criteria selection of educational films. In the Educational Sciences literature in Romania, there is little information on the classification of educational films (Ciascai, Dulamă & Marchiș, 2007). Criteria were completed for two of the identified classifications (production mode and purpose) and based on the analysis of the films, several criteria were established: author, duration, filming position, public and playback speed.

Regarding the choice of the educational film for a learning activity, it is considered that this should meet several criteria: qualitative (clear picture, normal frame rate – 25 FPS, Romanian soundtrack), technical (digital format, the possibility to be played with the equipment provided by the teacher, no longer than 10-15 minutes, in order not to lose the students' interest), pedagogical (to highlight the topic, the content to correspond to the pursued objectives and the students' characteristics, to allow the teacher to use teaching strategies and to make comments or ask questions during its watching).

Selecting a film from the multitude of digital resources is difficult to achieve as watching this film selection takes a long time. There could also

be the possibility for the teacher or the elder students to make films, with the video camera or the smartphone, but the environmental conditions, the human and financial resources, the technical skills are not always suitable.

3. The analysis of the educational film. The film "Bean Time-Lapse - 25 Days | Soil Cross Section" (https://www.youtube.com/watch?v=w77zPAtVTuI). Based on the established criteria, it can be considered that the chosen educational film is a digital film made by professionals, with a short duration and intended for the general public. It is filmed from the ground surface. The film is valuable because it shows the development of the roots of the plants, an aspect that cannot be observed directly by the students in reality.

To establish the connexion between the plot of the film, the objectives, and the content of the lesson, the film was watched several times. The main problems and the sequence of the frames were noted. The weaknesses of the film are the following: not showing the flowering and the fruiting, having a musical soundtrack, and not a verbal presentation in which to expose the film's content. To increase the efficiency of the film the teacher can switch the film on the mute mode to explain what is presented or to change the soundtrack of the film.

4a. Analysing the learning activity no. 1: watching the movie by the EG and the CG. The preparation of the equipment used to watch the educational film (computer, video projector, video card, sound card, speakers, software, etc.) was previously done during the break before the activity time.

Before watching the film, the objectives were introduced to the students, and the students in the EG received and read the questions in the study guide. Since the flowering and the development of the fruit are not presented in this film, during the documentation stage for the activity, a film presenting the flowering and development of the fruit at the pumpkin was also selected. To respect the time management and not stir confusion, only the film about beans was used, joined by other illustrative resources. During the learning activity, the film was played without interruption, the teacher not pausing for analysing or discussing certain aspects. This procedure was meant to observe the understanding and the level of knowledge acquired by the students after watching this film without an explanatory soundtrack.

This activity reproduced a situation in which the students watched a science-based film individually, without the support of an adult (the CG) and another one in which the students watched a science-based film individually, but their observation was indirectly conducted by asking questions from a study guide (the EG).

The results obtained by both groups in test 2, applied immediately after watching the film, prove the inefficiency of this single film viewing activity. Moreover, the study guide did not increase the understanding of

the film content. It was difficult for the students from the second grade – at the same time: to watch the film, to pay attention to observe the development of the plant and to complete the study guide.

The poor results obtained in test 2 by the EG can also be assigned to these shortcomings. It has been found that, although students have access to thousands of movies on the Internet, they do not understand their content unless it is explained by the film's author. They need a person to mediate their knowledge about the reality presented in educational films.

In contrast to these films, the ones in which the characters' actions are introduced are easier to be understood by the children. They understand easier what these characters do and often the subject of the story is told before watching the film by the teacher or parents' readings.

4b. Analysing the learning activity no. 2: discussion after watching the film with the students from the EG. After watching the film, the teacher addressed the questions in the study guide to all the students in the EG and some other questions. At some questions, the students were able to answer based on observing the development of the plant during the film, but also needed some previous knowledge (root, stem, leaf, sprouting/ germination). Furthermore, they needed the teacher's support to correctly and completely answer the questions.

To answer the new questions (Table 6), besides the questions included in the guide, students were asked to determine how the environmental conditions influenced plants. These cause-effect relationships are not visible in the film they had watched, and students needed previous knowledge and experience to be able to answer those questions. Also, during that series of questions, the students needed guidance from the teacher to give the correct answers.

Table 6. Heuristic questions addressed to students, about the influence of environmental factors upon the plant

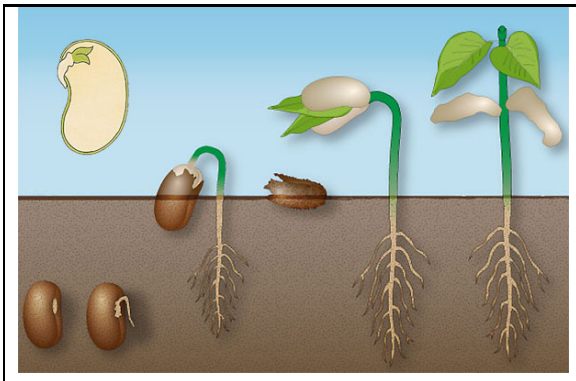
What conditions does the bean seed need for the plant to grow?
What happens to the bean seed if the ground/soil is dry?
What happens to the bean seed if the ground/soil is very wet?
What happens to the bean seed if the ground/soil is thick?
What happens to the bean seed if the ground/soil is cold?
What is the name of the part of the plant that grows on the surface of the earth?
What conditions does the bean require to develop the stem? (heat, light, water)

After the conversation based on the film, the students received, for the purpose of strengthening their knowledge, a fact sheet about the life cycle

of the beans, which they stuck in their notebook for optimizing the time resources. One student read the text in the file (Figure 4), and the others followed closely. They were asked several questions (Table 7). The students offered verbal answers to the questions, using the information from the text provided. The support offered by the teacher in shaping the answers was considerably lower compared to the previous answers in the guide because they now had previously acquired knowledge, as a result of the learning activity under the guidance of the teacher.

Table 7. Oral guide about the life cycle of the plant

What do the pictures represent?
What does the germination process mean?
What are the parts of the plant that develop as a result of germination?
When does the plant life cycle end?



Development of the bean from seed to plant

https://www.gimnaziu.info/samanta-germinatia-etapele-germinatiei

Beans leaves, flowers and fruits (pods)

https://www.thompson-morgan.com/p/runner-bean-white-lady/231TM

The life cycle of a plant is the succession of stages of plant development, from seed to the mature plant, with new seeds.

The stages in the life cycle of a plant are: seed - germination - seedling (young plant) - mature plant - seeds.

Germination or sprouting is the awakening of mature seed to active life, leading to the birth of a plant. The organs of the plant will be developed in turn: the root, the stem, the leaves, the flowers, and the seeds. The appearance of the seeds ends the life cycle of the plant (Grigore et al., 2016).

Fig. 4. The life cycle of the bean

The students received the second sheet (Table 8), about the growth and the development of plants and the favourable environmental conditions for their development. They stuck the sheet in the notebook. Two students read ("aloud") an excerpt from the file, one at a time to listen to them all.

Students were advised to pay attention to the meaning of the words in bold (life cycle, growth, development), to the conditions that influenced the life of the plant. They underlined the unknown words from the text, and they asked for the explanation of terms such as stage, size of the plant, optimal conditions, fertile, bud, mature plant, deforestation, and adverse environmental conditions (Table 8). It was necessary for the second-grade students to decode the text as it required a high degree of understanding. After reading the text, they were asked the following questions (Table 9):

Table 8. Oral guide concerning the development cycle of the plant. Environmental conditions

What does the life cycle of the plant mean?
Are all plants disseminated by seeds?
What does plant growth mean?
What does plant development mean?
Which organs are formed when the plant develops?
What are the environmental conditions that influence the life of the plant?
What are the adverse environmental conditions?
When do plants have a complete life cycle?
How does man influence the life of a plant?
Can plants have diseases? How do these manifest?
How long can the life cycle of a plant last?
Which annual, biennial or perennial plants do you know?

Table 9. Plant growth and development. Environmental conditions

Some plants disseminate by seeds.
The life cycle of a plant comprises the stages through which a plant goes from the seed stage to the time when other seeds are produced.
Optimal living conditions (fertile soil, water, light, suitable temperature) ensure seed sprouting.
The radicle (root) comes out from the seed, which is oriented downwards, then the stem with a bud emerges, which is oriented upwards. The leaves from the bud begin to prepare the food necessary for the growth and development of the plant. Then the flowers, fruits, and seeds appear. At the end of its life cycle, the plant dies.
The growth of the plant means increasing its size and weight.
The development is the progression of the plant through several stages, from seed to the mature plant. Some plants do not go through a life cycle due to diseases, negative human intervention (deforestation, soil, air pollution of the soil, air, etc.) or adverse environmental conditions. The life cycle of plants is different. Some plants have a life cycle of one year (peas, beans, corn, wheat, etc.), others of two years (carrot, onion, cabbage, etc.) or of several years (roses, fruiter, various trees, etc.) (Piţilă & Mihăilescu, 2016).

The students expressed a particular interest in the consequences of human intervention in the life cycle of the plants. They asked additional questions about these interventions (deforestation, engrafting, cleaning of dried branches, marcotting, tree dusting) and they exemplified with their family experiences.

To strengthen the knowledge and for self-evaluation, the pairs of students were given the task to stick each image that represents a part of a flower in the box corresponding to its name (Figure 5). The students participated actively in this activity, dividing their tasks. They put the images in the box with the appropriate name. They were advised to discuss with their team-mate before matching the image with its name. During the Visual Arts and Practical Skills class, they coloured the images (Figure 6).

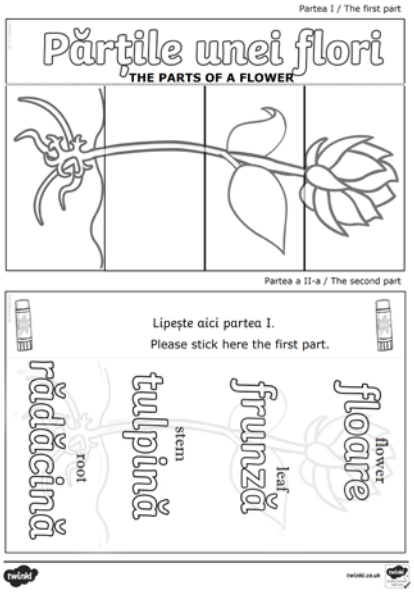


Fig. 5. The parts of a flower (https://www.twinkl.co.uk/resource/ro-t-t-13786-partile-unei-flori-fisa-de-lucru)

The teacher displayed eight posters on the board (Figure 7), representing the stages of sowing and sprouting of a plant in pots. Each poster described the stages, the necessary materials and the environmental conditions suitable for the development of the plant. The purpose of the activity was to observe the growth and the development of a plant in pots. After studying and discussing these posters, the students sowed 2-3 beans, on a layer of cotton wool, which they moistened, in a plastic cup. Each student took the cup home, to ensure the environmental conditions necessary for the development (light, heat, water, even to change the cotton with the necessary soil). After the winter holiday, they returned with the plant to compare its development with the plants of their classmates and to analyse the causes that determined their development/ drying/ yellowing/ rotting.

Fig. 6. Aspects of student activity
Source: Ana-Simona Ilie

Fig. 7. The stages of sowing and sprouting of a plant. Environmental conditions (https://www.twinkl.ro/resource/ro-t-t-859-how-to-grow-a-plant-posters-romanian)

CONCLUSIONS

The planning to use the educational film in class is a long process in which the teacher has to spend a long time to select the film that meets the content and quality criteria listed, to watch and review it, to note the problems and the sequence of the frames, to identify the proper integrating methods and the optimal timing for playing the film.

The present action research led to the conclusion that it is not enough for the students to watch the educational film by themselves. Not even the use of the study guide can have an essential contribution to knowledge development if the students do not have some previous knowledge about the subject. The teaching process can be improved in *Mathematics and Environmental Exploration* by using an educational film if the students are involved in active learning activities, coordinated by the teacher, in which they may watch the film again and discuss its content with the teacher.

The understanding and achievement of correct representations are also facilitated by using other visual materials and texts. The students' level of knowledge in the field of Natural Sciences increases if the most appropriate educational film is used for the given topic and if the students are guided by the teacher in decoding the visual content.

The strategies based on watching an educational film and on the teacher systematically directing the learning process lead to shaping correct representations about the environment, to improving their observation and thinking (comprehension, reasoning) skills, to developing their knowledge and learning value in primary school.

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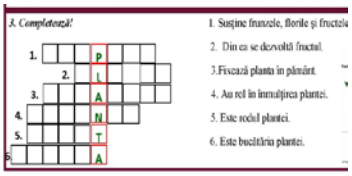
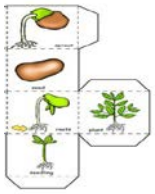
Appendix A

Testing the experimental group and the control group

Initial Test (1)	Test 2	Test 3
- to indicate the name of the parts of flowering plants according to their role; 1. Circle the solution and complete the crossword:  - to order the stages of the plant development cycle; 2. Number, from 1 to 4, the stages of the plant development cycle:	- to order the stages of the plant development cycle; 1. Number, from 1 to 5, the stages of the plant development cycle:  - to identify the name of the parts of flowering plants according to their role; 2. Complete the short text:	- to order the stages of the plant development cycle; 2. Number the stages of the plant development cycle:  - to identify the name of the parts of flowering plants according to their role; 2. Circle the correct answers: a. parts numbered with 1 and 2 lead the water and the mineral salts; b. the parts of the plant, from 4 and from 6, determine the

- to identify the environmental factors and how they influence the development of the plant;

3. True or false! Write A for true statements and F for false ones.

The plant consists of ……
……
……
…… absorbs water and minerals from the soil and supports the plant.

…….. supports the plant and transports mineral salts and water to the leaves.

…….. produce plant nourishment and release oxygen.

…….. produce the fruit and play a role in propagating the plant.

…….. produce seeds, with the role of propagating the plant.

- to identify the environmental factors and how they influence the development of the plant;

3. True or false! Write A for true statements and F for false ones.

The plant grows fastest when it constantly rains.

☐ The hotter the sun burns, the faster the plant grows.

☐ The plant becomes yellow and fades, if kept in the cold.

☐ The soil gives the food and water to the plant.

☐ The plant must have heat and light in order to grow.

☐ The plant absorbs carbon dioxide from the air and releases the oxygen needed for life.

formation of fruits;

c. Image number 1 represents the fertile soil, without which the plant could not develop;

d. The kitchen of the leaf is represented in picture no. 3;

e. the image no. 5 represents the fruit with seeds;

f. The leaf is green due to the photosynthesis.

- to identify the environmental factors and how they influence the development of the plant;

3. True or false! Write A for true statements and F for false ones.

☐ If it rains for two weeks, the plant will not grow, but stay small or will not bear fruit.

☐ In winter, we can grow plants outside, if we do not water them.

☐ The depth of the seed in the soil does not matter.

☐ If a room is heated, it is enough to grow a plant.

☐ The beans can also be developed in a linked bag.