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# THE USE OF ANIMATION FILM FOR STUDYING THE WATER CIRCUIT IN NATURE

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## Abstract

Worldwide, there is a tendency to make animated films in order to motivate children to know more complex aspects, located at a great distance, difficult to access or even dangerous. Animated films allow the presentation of many aspects made in a simplified way. Primary school teachers in Romania face several problems in the use of animated films: lack of films on certain topics, inadequacy of the soundtrack for the purpose pursued in teaching, limited time resources, etc. In this research we identified some animation films that can be used in the study of the water circuit in nature by students in the primary cycle and we improved them by increasing their degree of interactivity. The films were valorised in an action research, structured in three stages: a stage in which we tested the previous knowledge of students, a stage focused on watching movies and decoding the information transmitted through them, a stage of testing knowledge to establish the progress made by the students as a result of the learning activity in which they were involved. At the end of the research, we found that teachers spend a lot of time finding and preparing movies for the lesson and that students need ongoing guidance to understand their content and to engage in logical and systematic learning.



*Keywords:* Interactive learning, educational platform, computer-assisted learning, primary education, natural science

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## 1. Introduction

Transferring official school activities exclusively online in the spring of 2020 has been a real challenge for teachers, students and parents. Teachers were forced to adapt quickly to the new conditions, to study learning platforms and numerous applications available for free on the Internet and to experiment, to facilitate and support the students' process of understanding and learning, to increase the attractiveness of the proposed offer for learning and to facilitate assessment. The Internet offers a multitude of web resources and useful applications in learning mediation, the teacher having the task of directing student's cognitive processes by using the most appropriate virtual learning environments in order to improve their performance. The access to high speed internet and digital devices at a reasonable price for many Romanian citizens, allowed their use in the act of teaching-learning-assessment carried out in the online environment, optimized by using multimedia products, carrying information in various forms (sound, text, image) and products (animation, film) (Ceobanu, 2016).

The use of animation films facilitates knowledge of natural sciences (Dulamă, 2001; 2008; 2013; Dulamă & Gurscă, 2006; Dulamă & Ilovan, 2007; Dulamă et al., 2019), especially because it presents dynamic information, which is not available in static materials (Lowe, 2003). The correct understanding of the contents represented in the animated film and in-depth learning depend on the teacher's skills, he or she having the main role in directing the process of understanding, learning, fixing and updating knowledge in memory (Vereș & Magdaș, 2020). Regarding the teachers in Romania, it is noted that they are interested in developing their digital skills (Dulamă, Ilovan & Magdaș, 2017; Magdaș et al., 2017; Magdaș, Dulamă, et al., 2018) and to use digital products in the instruction process (Magdaș, Ilovan, et al., 2018; Magdaș et al., 2019; Rus et al., 2019), all these being visible in the groups of teachers, very active and cooperative on social media.

## 2. Problem Statement

Because there is no database of Romanian animated films for the education system, teachers must search for such films on the Internet and watch many films to choose the most suitable one to use in a lesson. Even if teachers invest large amounts of time to identify the necessary films, the search results are not always as expected. For many subjects in the field of natural sciences, there are no films, and the available films often have the soundtrack in another language, are long or are not adequate to the class of students' level of knowledge. In order to be able to use an animated film in a lesson, the teacher has to solve these problems (shortening or fragmentating the film, changing the soundtrack). This is how the problem of this research is outlined: How does the primary school teacher proceed to use a film efficiently in a natural science lesson?

## 3. Research Questions

We aim to answer questions that the teacher should also answer to solve the problem: Where should the teacher look for animated films for the theme of "Water circuit in nature"? What are the most effective ways to find films? How can the degree of interactivity and attractiveness of the film be increased for the

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students to understand its content? How does the teacher use written and visual materials in the learning activities about the "Water Circuit in Nature" conducted online with the students? How effective are these online activities?

## 4. Purpose of the Study

The aim of this study is to analyse the approach taken by a primary school teacher to identify animated films, applications, learning platforms and other products available free of charge on the Internet to build virtual learning environments in which to involve students from the class with which she organizes official online learning activities, in the context of the spread of a pandemic worldwide. The analysis also aims to evaluate the results of students obtained in a learning activity based on the use of an animated film and other materials created or improved through online applications and distributed through a conference platform to establish the efficiency of their use.

## 5. Research Methods

### 5.1. The experimental design

We went through several stages:

(1) On June 9, 2020, at 9:00 am – it was applied to both groups the Pre-test (Test 1) to identify students' knowledge on this subject. The test conducted by the teacher was posted on the platform wand.education (Vereș, 2020b). The duration of the test was 15 minutes, the items were read by the teacher, and the students selected the correct answer to items 1 and 2 and chose the true or false answer to item 3.

(2) On June 9, 2020, at 10:00 am – the students from both groups were involved in learning activity no. 1. The students watched individually, at home, the film "Paxi - The water circuit in nature" (ESA, 2017) which was sent to the class group to be watched until 12 am.

(3) On June 9, 2020, at 12 am – it was applied to both groups the Post-test (Test 2). The test created in Google Forms by the teacher was applied on zoom.us chat and sent to the chat of this platform.

(4) On June 9, 2020, at 3 pm – the students from both groups were involved in learning activity no. 2 in which the students reviewed the film. The question film was posted on the class group with the requirement to answer the questions until 8 pm (Vereș, 2020a). The verification and the analyses of the answers on the class group was given to the students on June 10, starting with 8 am.

(5) On June 10, 2020, at 10 am – the students from the experimental group were involved in learning activity no. 3. It was initiated a meeting on zoom.us in which the students discussed with the teacher, received additional information and explanations from the teacher based on a PPT presentation, played in pairs the proposed game ("Water circuit in nature- game", https://www.twinkl.ro/resource/ro-t2-s-727-water-cycle-game-romanian);

(6) On June 10, 2020, at 1 pm – it was applied to both groups the Retest (Test 3) to determine the volume of their knowledge about the presented topic. The test created by the teacher on zoom.us was sent to the chat of this platform.

The tests included similar items related to the water circuit in nature, evaporation, condensation, solidification, melting, precipitation, collection, groundwater, recycling. The tests degree of difficulty

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increased from test 1 to test 3. The information evaluated in the three tests was correlated with the content of the animation film. The maximum score that could be obtained in a test was 10 points.

### 5.2. Data collecting and processing

Data were collected through three tests applied to students in the experimental and control groups. The text of the film was subjected to a thematic analysis of content, and the images of the film were analysed by visual methods.

### 5.3. Participants

16 first grade students of the "Lucian Blaga" Gymnasium School, from Jibou, Sălaj County participated at this research. Students easily used the learning platforms wand.education, edpuzzle.com and zoom.us because since March 13 school activities had been carried out exclusively online and had frequently used these platforms. Based on the averages obtained at the first test, we formed two equivalent groups: an experimental group (EG) and a control group (CG), each of eight students. The first author of this article designed and organized the activities with the students, who perceived her as their teacher, not as a researcher.

### 5.4. The research material

The research material was represented by the animation film, the development of the learning activity, the students' behaviour, the content used in the activity and the students' answers to the three tests.

## 6. Findings

### 6.1. The identification of the criteria for analysis and selection of animated films for a topic

To choose the film for this research, we took into account previous research on environmental education (Deac et al., 2019; Dulamă, Ilovan & Magdaş, 2017; Ilovan et al., 2018) and watched several animated films on YouTube: "Paxi - The Water Circuit in Nature", offered by the European Space Agency ESA (2017), "The water cycle - Understanding the Process - Junior Section (Classes KG-V)" offered by Extramarks, "The water Cycle - How rain is formed - Lesson for kids" offered by Learning Junction and "The Magic Bus, Season 2, Episode 19 – Raindrops" offered by Phenom-network. After evaluating these films, we chose the animated film "Paxi - The Water Circuit in Nature" because it satisfies several criteria: the existence of the verbal soundtrack, the explanations are offered by an animated character, already known by children, the short duration of the film (4.08 minutes) is optimal for viewing by students of the first grade, the adaption of information to the children's age level, the existence of the explanation of the water circuit in nature in the text provided by the animated film.

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Corresponding Author: Ioana Magdaș
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## 6.2. The specific aspects of an animated film addressed to children about knowing the environment

From the analysis of the animated film "Paxi - The water circuit in nature", we found several features. A film intended for viewing by children should contain all the elements necessary to be attractive for them and keep their attention focused throughout it. The attention is captured by a character with a simple name, easy to pronounce and remember by children, Paxi, who assigns his role of "favorite space researcher" of the child. This character stimulates and capitalizes on the child's native curiosity, approaches him individually when he is introduced to the theme ("Today I will tell you about the water circuit in nature"), gives him some information from the category of "curiosities" framed interrogatively ("Did you know that …?") and invites him on an "adventure" during which to show him how this circuit takes place. In order to adapt the specific content of natural sciences to the child's requirements, the text has a narrative form.

The text of the film contains 458 words. Through this text, the film provides a lot of information specific to natural sciences, and of these about 30 concepts are needed to understand the water circuit (which are marked in the text).

"Paxi - The water circuit in nature

- Aaa… On a hot day nothing is better than a glass of cold water!

- Hi! I'm Paxi, your favorite space researcher, and today I'm going to tell you about the water circuit. Did you know that the water I drink is the same as the dinosaurs drank 200 million years ago? And is it the same water you will drink in 50 years? As you know, in order to survive, every being on Earth needs water: plants, trees, animals and, of course, humans. But the Earth has only a certain amount of water, and this amount is the same today as it was 4 billion years ago. This water flows again, and again, and again. This circulation of water is called the water circuit. It is the clever way in which mother nature recycles her water.

- Come on, I'll show you how this is made! When the sun rays warm the Earth, the temperature of the water in rivers, lakes and oceans rises. Then some of the water evaporates into the air becoming a gas, called vapour or steam. This is called evaporation. As water vapours move through the air, they cool down and turn back into liquid droplets. This is how clouds are formed. This process is called condensation. When a lot of water has condensed and the air can no longer hold so many drops, the water falls back to Earth. The water's fall on Earth can take place in different forms: rain, hail, sleet or snow. These are precipitations. Rainfall is not always welcome. For example, when you want to play outside. All the water that falls back to Earth will be collected in different ways. This is called collection. The water that falls into the oceans, lakes and rivers will evaporate again and begin a new cycle. The water that falls on the ground is absorbed by it and becomes groundwater that plants, animals and humans drink. The water that falls on the vegetation evaporates again through the leaves of the plants. But do you know

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> what happens to water that falls in the form of snow on the glacier? One part freezes keeping the glacier alive, and another part is melted by the sun and flows into rivers. Ingenious! Isn't it? Wherever it falls, the water is always recycled. Your planet is truly extraordinary! So today we learned that: in order to survive, all living things need water; the water on Earth is the same as it was four billion years ago; the water evaporates and forms clouds and then falls back to Earth. It is collected in oceans, lakes and rivers; and water is always recycled. Goodbye! See you soon for our next adventure through the wonderful Universe!" (ESA, 2017)

We notice that, on average, almost eight concepts per minute are transmitted during the film, which means a lot. We grouped these concepts into categories: meteorological phenomena (evaporation, condensation, solidification, melting); precipitation that occurs in the atmosphere (rain, hail, sleet, snow); aggregation states (solid, liquid, gaseous / vapor / steam); hydrological processes (water accumulation, collection, infiltration ("absorbed"), recycling; hydrographic units (rivers, lakes, oceans, groundwater). To these are added three more sets of information, presented in explanatory text fragments, regarding: the cause and the way of running the water circuit; the spread of water in nature; the importance of water for plants, people, animals and the negative effects of the water circuit.

### 6.3. Increasing the interactivity of the animated film

Starting from the premise that, in relation to the animated film, the student has a passive role because he watches the images and listens to his soundtrack, for the second learning activity, we wanted students to solve certain tasks – exercises and questions – while watching. In the didactic works, it is recommended the fragmentation in small sequences of watching the film and alternating these sequences with questions for students to facilitate their identification, understanding, explanation of the content watched in the video (Dulamă, 2000, p. 101).

We increased the interactivity of the animated film with the help of the *Edpuzzle* tool (edpuzzle.com), designed especially for teachers or students, available for free online and which allows a teacher to create a maximum of ten lessons for free, after creating an account using gmail.com. This application provides four tools that can be used to: cut a sequence from the video; remove the original soundtrack of the video; insert a soundtrack at or around a point in the video; creating a test, at a certain moment, with open questions, multiple choice and comments.

In order to guide the students from the experimental group in learning new concepts, we chose to ask them open-ended questions while watching the film (Table 01). Through these questions we aimed to achieve the following objectives: defining concepts (water circuit, groundwater, collection, etc.), specifying the stages of the water circuit in nature, listing the forms / states of aggregation in which water is found in nature. The students in the experimental group answered these questions, in writing, in the notebook, during the review of the film and sent the answers, as photos, to the class group. From the analysis of the answers, we found that the students had difficulties in understanding some concepts: condensation (two students), water circuit in nature (two students), groundwater (one student) and evaporation (one student). Identifying

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the difficulties was useful for us because we clarified them in the explanations that followed in the direct activity.

**Table 1.** Questions attached to the animated film through the *Edpuzzle* tool

| Minute | Questions |
|---|---|
| 0:52 | Why do all beings on Earth need in order to survive? |
| 1:40 | What happens when the sun rays warm the Earth? |
| 1:53 | How do clouds form? |
| 2:25 | In what form does water fall to the Earth again? |
| 2:33 | What do you mean by collecting water? |
| 2:53 | What happens to water that falls on vegetation? |
| 2:58 | What water is used by plants, animals and people for drinking? |
| 3:15 | What happens to snow under the action of the sun rays? |
| 3:51 | What do you mean by the water circuit in nature? |

### 6.4. The analysis of online activities

In March 2020, the students were involved in learning activities about the states of aggregation and water transformations, during three lessons in the *Mathematics and Environmental Exploration* course. They had access to the lesson "Water transformations: evaporation, condensation, solidification, melting", created by the teacher and posted on the wand.education platform (Vereș, 2020b). The information was transmitted in the form of speaking text. From the lesson page, there were two links to the ȘcoalaIntuitext website, but they were accessible only if the student had an account. The second link allowed access to a game. At the end of the lesson were the items from Test 1. In these activities, students gained knowledge about the states of aggregation (solid, liquid, gaseous), transformations of the state of water aggregation and the physical phenomena that accompanied these transformations (evaporation, condensation, solidification, melting).

In June 2020, we organized the two learning activities based on the film "Paxi - Water Circuit in Nature" (ESA, 2017). The first activity aimed to watch the film without specifying some cognitive objectives, being like the activities in which students watch alone, at home, various films on the Internet. Although students watched the animated film only once, they did not receive support from teacher or parents. Thus, the test results applied immediately after viewing indicate the effectiveness of this learning activity (Table 02).

The second learning activity – watching the film with associated questions – increased both the degree of interactivity between the film and the students, and the learning efficiency of the students in the experimental group. After checking the written answers to the questions introduced in the film, the third learning activity was organized as a video conference on the Zoom platform, lasting 40 minutes. Most students said they understood what the water circuit in nature was. At the teacher's request, they asked some questions: "How does water evaporate from the seas and oceans?", "Why does it rain more in the mountains or is it snowing in summer?", "How is water polluted?" These indicate the students' curiosity and interest, their aim to deepen knowledge about this topic, but require large resources of time to clarify them. Some of the answers to these questions were discovered in a PowerPoint Presentation about the Water Circuit in nature offered to students by the teacher (https://www.twinkl.ro/resource/circuitul-apei-in-natura-

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Corresponding Author: Ioana Magdaș
Selection and peer-review under responsibility of the Organizing Committee of the conference
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prezentare-powerpoint-ro T2-s-243). Being an oral assessment and knowledge fixation activity, the teacher explained again what this cycle meant and inserted during the explanations the answers to the questions. Students were asked to solve some tasks from the worksheet (https://www.twinkl.ro/resource/ro-t2-g-161-water-cycle-labeling-worksheet-romanian) and a game "The wheel of the water circuit" (https://www.twinkl.ro/resource/roata-circuitului-apei-in-natura-activitate-ro-tt-10444) in which they filled in and applied labels in a lacunar text, on a schematic drawing. The students also received on the class group a game "Game - Water Circuit in Nature" (https://www.twinkl.ro/resource/ro-t2-s-727-water-cycle-game-romanian), in written and electronical format which they could play with siblings or one of the parents.

### 6.5. The efficiency of using the animated film

The results of the 16 students in the Pre-test (test 1) (Table 02) indicate a good level of knowledge about the states of aggregation and water transformations and confirmed that some students have a higher volume of knowledge than others, the grade point average was 8.94, and the range of grades was between 6 and 10. In the experimental group, the average was 9, and in the control group it was 8.88. The results of the Post-test (test 2) are poorer than those obtained in the Pre-test. The average of the class was 8.75, the range of grades was between 6 and 10. In the experimental group, the average was 9.38, and in the control group it was 8.13. One of the causes that determined this difference between the results obtained by the students in the experimental group compared to those in the control group was the impatience of two children in the control group to "get rid" of tasks. Analysing the moment when the students sent the answers, we found that one of the students who obtained a lower grade in the test sent the answer 11 minutes faster than the class, and a student who took the score 9 in the initial test and in the 2$^{nd}$ test had a score of 6 had problems with the internet connection at the end of the test and also he was scared that he encountered difficulties. The duration of the application of test 2 was 59 minutes because some children had problems with the internet connection, which is a very long amount of time for the first-grade students, who are 6-8 years old.

In the Retest (test 3), the average of the experimental group was 9.63. Students who scored 10 on test 1 and test 2 still got the same score, two students got a score with 1 point higher than to test 2, and two students got a score one point lower than the test 2. From the discussion with the mother of one of the students who obtained a lower score, we found out that, initially, the child chose the wrong answer, later became aware of the mistake, but the computer did not allow him to change the option. After the students sent the answers to the teacher, they had the opportunity to see the score obtained and the correct answer to the questions they answered incorrectly. This is an advantage for students because they receive a quick feedback, but also for the teacher, whose work was taken over by the program. The teacher has access to the statistics that the application generates: the distribution of the total number of points, the analysis of the answers provided by the students to each question, but also an analysis of the answers of each student. Students' results on the three tests (Table 02) indicate a significant increase in the volume of students' knowledge about water aggregation states, phenomena and processes that occur in the water circuit in nature as a result of involvement in learning activities based on watching the animated film.

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Corresponding Author: Ioana Magdaș
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**Table 2.** The analysis of the results obtained by students in the three tests

| Test 1 | | | Test 2 | | | Test 3 | | |
|---|---|---|---|---|---|---|---|---|
| **Questions** | **No. of correct answers** | | **Questions** | **No. of correct answers** | | **Questions** | **No. of correct answers** | |
| | **EG** | **GC** | | **EG** | **GC** | | **EG** | **GC** |
| The transition phenomenon of the water from liquid to vapor state at the surface of the liquid is called:<br>**1. evaporation**<br>2. condensation<br>3. solidification | 8 | 6 | Under the influence of the Sun heat, the water on the surface of rivers, seas and oceans:<br>1. condenses<br>**2. evaporates**<br>3. solidifies | 8 | 5 | Choose the word that fits.<br>a) Rainwater is ..... in rivers, seas and oceans.<br>**1. collected**<br>2. eliminated<br>3. cooled | 8 | 6 |
| The transition phenomenon of the water from liquid to solid is called:<br>1. condensation<br>**2. solidification**<br>3. melting | 8 | 7 | When water vapor encounters cold layers of air they:<br>**1. condense**<br>2. evaporate<br>3. solidify | 6 | 3 | b) When water vapor encounters cold layers of air they:<br>**1. condense**<br>2. evaporate<br>3. melt | 6 | 6 |
| The transition phenomenon of the water from the vapor state to the liquid state is called:<br>**1. condensation**<br>2. evaporation<br>3. melting | 6 | 8 | The clouds are made up of:<br>**1. water vapor**<br>2. smoke<br>3. dust | 8 | 7 | c) The state of rainwater is:<br>1. solid<br>**2. liquid**<br>3. gaseous | 8 | 8 |
| The transition phenomenon of the water from solid to liquid is called:<br>1. condensation<br>2. solidification<br>**3. melting** | 7 | 8 | Rainfall is:<br>1. Rain, dust, snow<br>**2. Rain, snow, hail**<br>3. Rain, snow, smoke | 8 | 8 | d) Under the influence of the sun rays, snow:<br>1. solidifies<br>2. evaporates<br>**3. melts** | 8 | 8 |
| What happens to water if we dry wet clothes?<br>Answer:<br>It evaporates | 6 | 6 | The transition of water from nature through the three states of aggregation represents .....<br>Answer:<br>The water circuit | 7 | 6 | What is the name of the water absorbed by the soil that the plants use?<br>Answer:<br>Groundwater | 8 | 7 |
| What happens to the water if the water vapor meets cold glass?<br>Answer:<br>It condenses | 6 | 6 | What happens to snow under the action of the sun rays?<br>Answer: It melts | 7 | 8 | What is the process of reusing water for a new cycle called?<br>Answer:<br>Water recycling | 7 | 7 |
| What happens to water if we leave the ice cream at room temperature for long?<br>Answer: It melts | 8 | 8 | What happens to the water on the leaves of plants under the action of the sun rays?<br>Answer:<br>It evaporates | 7 | 8 | What is the accumulation of water on the Earth's surface called?<br>Answer:<br>Water collection | 8 | 8 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Choose T if the sentence is true, or F if the sentence is false.<br>The water drops from the pot placed on the open eye of the stove as it solidifies.<br>Answer: F | 7 | 6 | Choose T if the sentence is true, or F if the sentence is false.<br>The water of the seas and oceans, the water from the surface of the soil and the one eliminated by plants through the leaves evaporates under the influence of the heat of the Sun and rises in the atmosphere forming clouds.<br>Answer: T | 8 | 6 | Choose T if the sentence is true, or F if the sentence is false.<br>Water on our planet is not recycled.<br>Answer: F | 8 | 7 |
| Choose T if the sentence is true, or F if the sentence is false.<br>Ice cubes disappear from the glass of juice left at room temperature as they melt.<br>Answer: T | 8 | 8 | Choose T if the sentence is true, or F if the sentence is false.<br>Through the phenomena of evaporation, condensation and solidification, water does not pass from one state of aggregation to another, circulating in the atmosphere.<br>Answer: F | 8 | 6 | Choose T if the sentence is true, or F if the sentence is false. During their circuit, the water changes its state of aggregation being successively in solid, liquid or gaseous state.<br>Answer: T | 8 | 7 |
| **Mean** | **9.00** | **8.88** | | **9.38** | **8.13** | | **9.63** | **9.00** |

Students who constantly show availability of learning are more active and more interested as the content of the lesson is transmitted in an interactive way and obtained very good results in the three tests. Students eager to complete the task, although they master the contents, obtained less good results, sending the solution to the test before being asked by the teacher. Students who showed learning difficulties prior to carrying out online learning activities partially or erroneously solved the tasks due to their inability to dose their effort and make full use of the time allotted to solve the tests. The results were also influenced by the degree / level of development of skills in handling digital tools, but also by the influence of external factors, such as poor quality / interrupted internet connection.

## 7. Conclusion

The selection of an animated film by a teacher to use it in a learning activity in the natural sciences in primary education is conditioned by observing some essential criteria: verbal soundtrack in the children's mother tongue, short duration, adequate content at the level of understanding and children's knowledge. Based on this research, we found that the teacher faces some difficulties in choosing the most appropriate animation film for studying the water circuit in nature: the existence of a few animation films in Romanian, too long, and musical soundtrack not verbal.

In order to increase the child's interactivity with the animated film and to increase the learning efficiency, the teacher who has an intermediate level digital skill, intervened on the animated film by introducing sequences with open questions, using free applications available on the internet. Other applications have been identified that are not always accessible free of charge to teachers.

The teacher, who has high level teaching skills, had a decisive role in mediating the knowledge of the lesson content by students in learning activities organized on the conference platform. Discussions with students, explanation of physical phenomena and geographical processes offered by the teacher after watching the animated film and knowledge tests contributed to facilitating the understanding of the water circuit in nature, to consolidating and systematizing knowledge in students' memory. Regarding students, the volume and quality of their results was strongly influenced in the activities organized online by their permanent interest and motivation for learning, the level of prior knowledge, their cognitive training, and their willingness to make an effort to solve tasks. Finally, in online learning activities, learning efficiency is influenced by digital competence, specialized skills and didactical competence, as well as by the teachers' availability to train and organize these activities with their students, the students' motivation to get involved in the learning process and to overcome difficulties and the parents' material and emotional support.

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