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OBSERVATION SHEET – AN ESSENTIAL TOOL FOR FACILITATING LEARNING

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ABSTRACT

This study explores the importance of scientific observation in primary education, highlighting how the use of observation sheets can facilitate the acquisition of knowledge and the development of students' observation skills. In the research, 153 second-grade students were divided into three experimental groups, each group observing a woody plant (spruce) using different materials: plant material, photographs, and drawings. The results show that direct observation leads to a more accurate identification of plant characteristics compared to observing substitutes or external representations (photographs, drawings). The study emphasizes the importance and effectiveness of observation sheets in achieving learning objectives and the necessity of engaging students in hands-on experiences to develop scientific thinking and skills.

Keywords: *spruce, observation, photographs, drawings, primary education*

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INTRODUCTION

Learning science at the primary education level requires an active approach, where students are encouraged to construct their own knowledge (Haury 2002; Johnston 2009) through the exploration and observation of the environment (de Bóo, 2006; Karamustafaoğlu, 2011) in activities organized in nature (Deac et al., 2019) or in forest environments (Dulamă et al., 2016).
Observation is an active process in which the observer selects and interprets information based on the study's objectives and the adopted conceptual framework (Russell et al., 1993). Scientific observation is an intentional process aimed at a specific purpose (Harlen, 2000). It involves the systematic investigation of phenomena and data analysis to answer specific questions (Gelman & Brenneman, 2012; Monteira & Jiménez-Aleixandre, 2016; Tomkins & Tunnicliffe, 2001). Observation is considered both a method and a teaching procedure (Dulamă, 2008) as well as a stage within instructional models (Dulamă et al., 2021).

The purpose of scientific observation is to collect precise and relevant data about a phenomenon or object, using appropriate senses and tools to identify distinctive characteristics and similarities (Rankin, 2006). Observation leads to the "polymodal, direct, attentive, and systematic perception of reality or its substitutes by students in the educational process" (Dulamă, 2008, p. 247). Observation is important in students' understanding of the environment (Dulamă, 2010) and the components of the geographical layer (Dulamă, 2011). It provides the foundation and optimal context for education about and for the environment (Ilovan et al., 2018).

Observation is conducted directly on objects, processes, and phenomena in reality (Dulamă, 2012), facilitates understanding of the anthropic impact on relief and vegetation (Rus et al., 2020), and enhances comprehension of the relationship between plants, animals, and their environment (Ilie et al., 2020). Observation is used in natural sciences and other educational disciplines to identify various aspects in photographs (Antal et al., 2015). Through observation, students develop skills in analyzing and interpreting images (Antal et al., 2020). Students gain environmental knowledge by observing drawings (Drăghici et al., 2020) and better understand plant growth by observing this process in films (Ilie & Cristea, 2020). Learning in science and geography is facilitated by watching animated films (Vereș et al., 2020; Dulamă et al., 2021). Given the importance of observation in the learning process, teachers should provide students with opportunities for observation (Sahnaz et al., 2018), sufficient time for observation, and discussion of observations, especially where this involves creating conceptual conflicts (Hand, 1988; Tomkins & Tunnicliffe, 2007) that are debated and argued (Naylor et al., 2004) in interactions with others (Johnston, 2009).

The literature highlights that social interaction and the mediation of knowledge by an adult play a crucial role in the development of scientific thinking in students (Vygotsky, 1962) and emphasizes the importance of autonomous practical experience, based on prior knowledge (Piaget, 1929). However, children's observational skills are often incomplete (Klahr, 2000; Rankin, 2006), and they struggle to interpret and connect what they observe (Ford, 2008). To develop their observational skills, children need appropriate tools and practical experiences to support their reasoning (de Bóo, 2006; Eberbach & Crowley, 2009) as well as support from others. Guided inquiry activities encourage students to actively and autonomously build their knowledge with the teacher's help (Kuhlthau, 2010). The observation sheet provides a structured framework for this sense-making process (Kuhlthau, 2010). Through these sheets, students are actively engaged in the learning process by observing, comparing, analyzing, and interpreting information. The observation sheet offers students a clear framework for formulating questions, collecting data, analyzing information, and drawing conclusions (Bodrova & Leong, 2015; Pahome, 2023).

By adapting the sheets to different age levels and learning contexts, teachers can create engaging and meaningful learning experiences for their students: identifying plant characteristics (Johnson & Tunnicliffe, 2000), observing an animal (Tompkins & Tunnicliffe, 2007), observing the external structure of a flower (Oguz & Yurumezoglu, 2007), identifying organisms' adaptations to their environment (Oguz & Yurumezoglu, 2007). Observation sheets can be adapted to various learning contexts: observing plants and animals in the schoolyard (Oguz & Yurumezoglu, 2007), exploring an ecosystem (Oguz & Yurumezoglu, 2007).

To maximize the impact of observation sheets, it is important that these tools are aligned with the specific learning objectives of the discipline (Dulamă, 2008), are used in interdisciplinary projects (Oguz & Yurumezoglu, 2007), and are used to assess practical skills (Eberbach & Crowley, 2009). By actively engaging in data collection and analyzing results, students build a deep understanding of scientific concepts and develop a positive attitude towards science (Bodrova & Leong, 2015).

Purpose and Research Questions

The purpose of this study is to compare the effects on students' knowledge of using an observation sheet for the components of a woody plant (spruce) and their characteristics in three conditions: direct observation of living plants—observing the spruce—and its components in photographs and drawings. We aim to compare the accuracy of identifying the morphological and general characteristics of the spruce when data is collected through direct observation versus data collected through observing plants in external representations—photographs and drawings—using an observation sheet.

To conduct the study, the following research questions were formulated:

Q1. To what extent does direct observation of environmental components (woody plants: spruce) lead to more accurate identification of the spruce's characteristics compared to identifying the same characteristics observed in photographs and drawings?

Q2. Which of the morphological components of the spruce presents the greatest difficulty in identification?

METHODOLOGY

Participants. The research was conducted during the 2021-2022 school year. The study involved students from three schools in the city of Târgoviște, Dâmbovița County, based on established partnerships. A total of 153 second-grade students, aged 8 to 9 years, participated in the study, including 86 girls. The participants were divided into three experimental groups, with two classes in each group as follows: Experimental Group A [GEA] – 51 students from the "Constantin Cantacuzino" National Pedagogical College, Experimental Group B [GEB] – 51 students from "Coresi" Gymnasium School, and Experimental Group C [GEC] – 51 students from "Mihai Viteazul" Gymnasium School.

Procedure. The quasi-experimental activity was structured into three distinct stages, conducted over the course of one week. The first stage, the pre-experimental phase, took place on Monday and consisted of a 10-minute pre-test. The second stage, the formative intervention, occurred on Tuesday and lasted 50 minutes. The final stage, the post-experimental phase, took place on Wednesday and included a 10-minute post-test. After analyzing the pre-test results, all students were included in the study as they did not possess the knowledge targeted to be acquired during the designed activity. During the formative intervention phase, the observation sheet was utilized. Scientific observation through the observation sheet was organized around the theme "The Spruce Tree: Components of the Tree" (Pahome, 2023b). The activity focused on identifying the characteristics of the components of a woody plant by observing spruce seedlings and parts of a mature spruce tree (GEA), photographs of spruce trees in their early years and maturity (GEB), and drawings of spruce trees in their early years and maturity (GEC) (Pahome, 2023a).

Conducting the Educational Activity. The observation activity included five stages (Pahome, 2023a).

(a) Organizing the Observation (5 minutes). In each group, the teacher explained how the observation activity would proceed and the objective: to analyze, using the observation sheet, the components of the spruce seedling and some components of the mature spruce and their characteristics directly in reality (GEA), in photographs (spruce trees in their early years and maturity) (GEB), and in drawings (spruce trees in their early years and maturity) (GEC). Each student in GEA received a spruce seedling, a spruce cone, a scale from the cone, and 2-3 spruce seeds. Later, in the same activity, GEA students observed mature trees in the schoolyard and compared the features of the components with those of the seedling. Each student in the GEB group received a set of photographs of the spruce seedling and mature trees, the cone, and spruce seeds, while those in the GEC group received a set of drawings with the same content (Appendix B). The observation of the materials was carried out in working groups of 4-5 students, with 11 working groups at each experimental group level. All students were tasked with individually observing the materials received and discussing the observed characteristic within the group. Based on the observation, they were required to complete a copy of the observation sheet distributed by the research teacher.

(b) Actual Observation Using the Observation Sheet (35 minutes). The teacher asked the students to identify, in groups, the components of the spruce, one by one, along with the characteristics of the components and to check the corresponding response option on the observation sheet (Appendix A).

(c) Verifying the Completion of the Observation Sheet (5 minutes). After the observation time had expired, the groups reported the solutions marked on the sheets. These were analyzed collectively to validate their accuracy. At the working group level, unmarked solutions were filled in with pencil, and mistakes in the sheet were corrected. The teacher collected the observation sheets from all working groups at the end of the activities.

(d) Formulating the Activity's Conclusions. The teacher discussed the activity with the students.

Instrument. Data collection was carried out using an observation sheet (Appendix A). The sheet is structured into the following sections: the name of the plant, its components, the characteristics of the components (the physical appearance of each part, the functions of each component, the relationship with other parts of the plant), and the general characteristics of the spruce tree (type of plant, lifespan, and growth pattern).

The 50 aspects intended for observation include the components of the spruce: the root (six characteristics), the stem (twelve characteristics), the leaves (twelve characteristics), the flowers (twelve characteristics), the seeds (four characteristics), and its general characteristics (four characteristics). For each characteristic, the sheet specifies two options. Students must check the correct response or option provided on the sheet. On the second page of the sheet, there are spaces for additional observations or questions.

RESULTS AND DISCUSSION

Table 1 presents the results obtained in the observation activity of the spruce tree, directed through the observation sheet, under the three experimental conditions (GEA, GEB, and GEC). For each observed component, the sum and average of the resolves classified as correct, incorrect, or incomplete were calculated.

Number of Correct Resolves

In GEA (observation of plant materials), 427 correct resolves (77.63%) were recorded out of a possible 550 correct resolves. The highest percentages of correct resolves were in the "General Characteristics" section (90.90%) and the "Seeds" component (84.09%). The lowest percentages were recorded for the "Stem" component (71.21%) and the "Leaves" component (75%).

In GEB (observation of photographs), 303 correct resolves (55.09%) were recorded. The highest percentages were recorded for the "General Characteristics" section (72.72%) and the "Seeds" component (65.90%). The lowest were recorded for the "Flowers" component (48.48%) and the "Root" component (46.96%).

In GEC (observation of drawings), 366 correct resolves (66.54%) were recorded. The "General Characteristics" section (88.63%) and the "Seeds" component (72.72%) had the best results. The lowest results were recorded for the "Flowers" component (59.84%) and the "Leaves" component (63.63%).

Number of Incorrect Resolves

In GEA, 100 incorrect resolves (18.18%) were recorded. The most incorrect resolves were recorded for the "Stem" component (25.75%) and the "Leaves" component (21.21%). The fewest incorrect resolves were recorded for the "Seeds" component (13.63%) and the "General Characteristics" section (6.81%).

In GEB, 202 incorrect resolves (36.72%) were recorded. The most mistakes were recorded for the "Flowers" component (44.69%) and the "Leaves" component (40.15%). The fewest mistakes were recorded for the "Seeds" component (22.72%) and the "General Characteristics" section (18.18%).

In GEC, 163 incorrect resolves (29.63%) were recorded. The most incorrect resolves were recorded for the "Flowers" component (38.63%) and the "Leaves" component (33.33%). The fewest incorrect resolves were recorded for the "Root" component (27.27%) and the "General Characteristics" section (11.36%).

It was found that direct observation of the spruce tree in reality (GEA) highlighted the most mistakes (25.75%) in identifying the characteristics of the stem; observation of the spruce tree in photographs (GEB) highlighted the most mistakes (44.69%) in identifying the characteristics of the flowers; observation of the spruce tree in drawings (GEC) showed the highest error rate for the "Flowers" component.

Table 1

Results for the three experimental conditions

Observed component		**Number of items**		**Resolves**					
		1 sheet	11 sheets	Correct		Incorrect		Incomplete	
				No.	%	No.	%	No.	%
GEA - Observing Natural Materials									
Characteristics of the components	root	6	66	54	81.81	12	18.18	0	0
	stem	12	132	94	71.21	34	25.75	4	3.03
	leaves	12	132	99	75.00	28	21.21	5	3.78
	flowers	12	132	103	78.03	17	12.87	12	9,09
	seeds	4	44	37	84.09	6	13.63	1	2.27
General characteristics		4	44	40	90.90	3	6.81	1	2.27
Total		50	550	427	-	100	-	23	-
Mean				77.63		18,18		4,18	
GEB - Observing Photographs									
Characteristics of the components	root	6	66	31	46,96	23	34,84	12	18,18
	stem	12	132	76	57,57	49	37,12	7	5,30
	leaves	12	132	71	53,78	53	40,15	8	6,06
	flowers	12	132	64	48,48	59	44,69	9	6,81
	seeds	4	44	29	65,90	10	22,72	5	11,36
General characteristics		4	44	32	72,72	8	18,18	4	9,09
Total		50	550	303	-	202	-	45	-
Mean				55,09		36,72		8,18	
GEC - Observing Drawings									
Characteristics of the components	root	6	66	43	65,15	18	27,27	5	7,57
	stem	12	132	89	67,42	36	27,27	7	5,30
	leaves	12	132	84	63,63	44	33,33	4	3,03
	flowers	12	132	79	59,84	51	38,63	2	1,51
	seeds	4	44	32	72,72	9	20,45	3	6,81
General characteristics		4	44	39	88,63	5	11,36	0	0
Total		50	550	366	-	163	-	21	-
Mean				66,54		29,63		3,81	

Number of Uncompleted Boxes

In GEA, 23 uncompleted boxes (4.18%) were identified. The most uncompleted boxes were recorded for the "Flowers"component (9.09%) and the "Leaves" component (3.78%). There were no uncompleted boxes for the "Root" component.

In GEB, 45 uncompleted boxes (8.18%) were identified. The most uncompleted boxes were recorded for the "Root" component (18.18%) and the "Seeds" component (11.36%). The fewest uncompleted boxes were recorded for the "Stem" component (5.30%) and the "Leaves" component (6.06%).

In GEC, 21 uncompleted boxes (3.81%) were recorded. The most uncompleted boxes were for the "Root" component (7.57% and the "Seeds" component (6.81%). There were no uncompleted boxes for the "General Characteristics" section.

DISCUSSION

Discussion on the Accuracy of Identifying Spruce Characteristics Directly, in Photographs, and in Drawings, Guided by the Observation Sheet

To answer the first research question, we determined the number of correct responses identified by students from all groups under the three experimental conditions. Across the three groups, there are significant variations in the number of correct responses for each characteristic of the observed spruce. Direct observation of components from nature (woody plants: spruce) or natural materials, using the observation sheet, had the highest rate of correct responses (77.63%). Indirect observation of nature components (woody plants: spruce) in drawings generated a lower number of correct responses (66.54%) in GEC. Indirect observation of nature components (woody plants: spruce) in photographs led to a lower number of correct responses (55.09%) in GEB compared to direct observation and observation in drawings. These results suggest that photographs are less effective in identifying plant components and their characteristics than direct observation of living plants and observation in drawings.

The fact that all groups had more correct responses in the "General Characteristics" and "Seeds" sections is most likely due to the participants' prior knowledge, reinforced by previous experiences in thematic projects such as "The Forest" and "The Life Cycle of Plants," as well as in various extracurricular activities. The fact that GEA had fewer correct responses in the "Stem" and "Leaves" components, GEB in the "Flowers" and "Roots" components, and GEC in the "Flowers" and "Leaves" components could be due to insufficient familiarity with the specific details of each component and a lack of understanding of these concepts.

Discussion on the Difficulty Level of Identifying Spruce Characteristics Directly, in Photographs, and in Drawings, Guided by the Observation Sheet

To answer the second research question, we determined the number of incorrect responses selected by students from all groups and the number of uncompleted boxes under the three experimental conditions. Direct observation of components from nature (woody plants: spruce) or natural materials, using the observation sheet, had a relatively low rate of incorrect responses (18.18%) and uncompleted boxes (4.18%) in GEA, highlighting that this type of visual stimulus is the most effective in helping participants correctly identify plant components and characteristics. Indirect observation of the spruce and its components in drawings led to a higher rate of incorrect responses (29.63%) and uncompleted boxes (3.81%) in GEC, suggesting that drawings are less effective in identifying plant components and their characteristics than direct observation of these living plants. Indirect observation of the spruce and its components in photographs resulted in a higher rate of incorrect responses (36.72%) and uncompleted boxes (8.18%) in GEB compared to the other experimental conditions. These results suggest that photographs are less effective in identifying plant components and their characteristics than direct observation of these living plants and observation in drawings.

Across the three groups, there is a significant number of incorrect responses, indicating that not all plant characteristics were fully understood. The fewest incorrect responses in GEA and GEB in the "General Characteristics" section and the "Seeds" component can be explained by both a good understanding of basic concepts about woody plants and the accessible nature of tasks related to observing seeds.

The most incorrect responses in GEA were recorded in the "Stem" and "Leaves" components, while in GEB and GEC, the most incorrect responses were in the "Flowers" and

"Leaves" components. The number of incorrect responses suggests that identifying the morphological characteristics of plants was a challenging task for the participants. Although GEA, GEB, and GEC obtained different results for different components, a common factor that could explain these differences is the complexity of the task of identifying stem, leaf, and flower characteristics. The results can be attributed to the large number of details that needed to be observed and differentiated.

In GEA, the "Stem" component was problematic, suggesting that participants had difficulty identifying observable aspects even when they had access to plant materials. In the case of observing photographs and drawings, the "Flowers" component was the most problematic. The high percentage of incorrect responses suggests that these materials did not provide sufficient visual cues for correct identification, and some aspects are difficult to observe (e.g., branch breakage, flexibility). The number of uncompleted boxes is relatively small, suggesting active involvement from the participants. The low number of uncompleted boxes in the "Flowers" and "Leaves" components (GEA), and in the "Roots" and "Seeds" components (GEB and GEC), indicates active involvement from all participants and good collaboration within the groups. This suggests that at the group level, participants reached a consensus regarding the observed characteristics.

CONCLUSIONS

The reduced number of uncompleted boxes and the similar choices, such as GEA's focus on "flowers" and "leaves," suggest that participants accurately observed and identified the main characteristics of the plants. These results indicate that the direct visual experience with natural materials enhances learning and retention of information about plant components compared to observing them in photographs or drawings. In the context of the "Spruce" topic, drawings appear to be more effective than photographs but less effective than natural materials.

The observation sheet provided an ideal framework for connecting theory with practice, facilitating the understanding of scientific concepts. The potential of this tool was maximized by meeting the following criteria: focus on learning objectives, clear and easily understandable tasks, flexible approach (both individual and group), and space allocated for noting additional observations.

To optimize the observation process, the researcher-teacher adapted the observation sheet to the specific characteristics of the 9-10-year-old age group, using accessible language and a concise format, allowing students to understand and complete the sheet autonomously.

In this study, differences in performance among participants were not influenced by prior knowledge (as indicated by the pre-test scores), task complexity, or the time allocated for observation.

The difficulty in identifying spruce characteristics varied depending on the observation materials. Photographs and drawings generated a higher error rate compared to direct observation, suggesting that two-dimensional visual representations may limit the ability to distinguish specific details of the species.

The complexity and variability of the visual characteristics of spruce stems and flowers were the main obstacles to accurately identifying them by the students. To improve future teaching activities, it is recommended that teachers pay special attention to how they present these components. The use of clear and well-structured visual materials, whether photographs, drawings, or direct observation of plants, can contribute to a better understanding of morphological characteristics and reduce the number of errors.

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Photographs and drawings used in formative intervention

Figure 1

Pahome, D. (2021). *Materials for the direct observation of spruce components*

Figure 2

2.1: NH State Forest Nursery (n.d.). *Spruce*. https://www.nh.gov/nhnursery/seedlings/white spruce.htm

2.2: Tree Seed Online Ltd (n.d.). *Spruce*. https://www.treeseedonline.com/store/p46/Norway_Spruce_%28picea_abies%29.html

2.3: Gardenia.net (n.d.). Picea abies. https://www.gardenia.net/plant/picea-abies-acrocona

2.4: Nefronus (2016). Picea abies. https://en.wikipedia.org/wiki/File:Picea_abies_cones_--_Czechia.jpg

2.5: *Spruces (Picea)*. https://www.bomengids.nl/uk/spruces.html

Figure 3

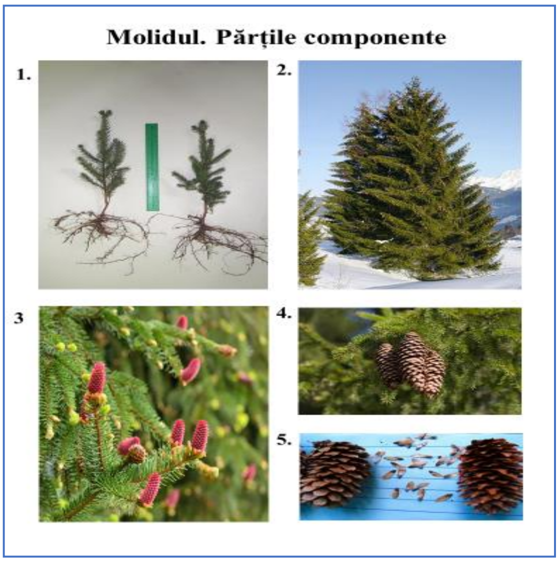
Ivan, A. (2021). *Spruce Tree. Component Parts. Unpublished Illustrations Created at the Request of the Research Professor.*

Appendix A

Figure 1
Materials for the direct observation of spruce components

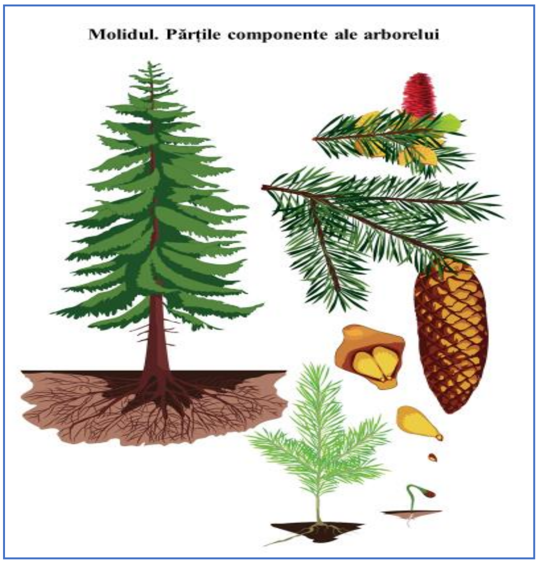
(Source: Pahome, 2021)

Figure 2
Individual material for observing spruce in photographs



(Sources:
1. NH State Forest Nursery, n.d.;
2. Tree Seed Online Ltd, n.d.;
3. Gardenia.net, n.d.;
4. Nefronus, 2016;
5. bomengids.nl, n.d.)

Figure 3
Individual material for observing spruce in drawings



(Sorce: Ivan, 2021)

Appendix B

Educational unit: ....   Name and surname of the student: ....

Spruce observation sheet

Task: Individual, observe the spruce sapling, a cone from the mature tree, a scale detached from the cone and the seeds in the bowl/drawing/photograph of the spruce. For each aspect observed, check the box next to the answer option that you consider correct. If you can't determine the answer, cross that row with a horizontal line.

Name of the plant: Spruce
The component parts:
* the underground part includes the root
* aerial part includes: stem (trunk and crown), leaves and flowers

Features of the component parts of spruce				
Root	a) it is woody (hard to break)	☐	stringy (breaks easily)	☐
	b) has a branched form	☐	of stake	☐
	c) the branches have an orderly appearance	☐	messy	☐
	d) has a reddish color	☐	gray gray	☐
	e) compared to the stem, it has a shorter length	☐	bigger	☐
	f) compared to the crown, it has a smaller extension	☐	great	☐
Stem	a) has its tip oriented towards the Sun	☐	the other trees	☐
	b) resin canals are found in its organs	☐	blood vessels	☐
crop	c) is right	☐	convolute	☐
	d) it is green	☐	marone	☐
	e) has a greater thickness at the base	☐	at the top	☐
crown	f) has the shape of a cone	☐	ball	☐
	g) has many branches	☐	few	☐
	h) the branches are arranged radially	☐	in one part of the stem	☐
	i) towards the top, the branches are rare	☐	thick	☐
	j) towards the top, the branches are shorter	☐	long	☐
	k) the branches are spindly	☐	inelastic	☐
	l) branches break easily	☐	with effort	☐
leaves	a) new leaves are dark green	☐	light green	☐
	b) when mature, they have a dark green color	☐	light green	☐
	c) the petiole (the part that orients the leaf towards the Sun) is present	☐	is missing	☐
	d) they are thin	☐	thick	☐
	e) are short	☐	long	☐
	f) are narrow	☐	wide	☐
	g) they are heart-shaped	☐	of needles	☐
	h) there are three edges	☐	four	☐
	i) on the branch, they are arranged in a spiral	☐	on one side and the other	☐
	j) their tip is pointed	☐	rounded	☐
	k) to the touch, their tip is soft	☐	sting	☐
	l) from the branch, they come off easily	☐	with effort	☐
flowers	a) bloom in spring	☐	summer	☐
	b) are grouped	☐	arranged one by one	☐
	c) the spruce cone is a fruit	☐	an inflorescence	☐
	d) inside, the cone has a central axis	☐	stone	☐
	e) cone scales are woody	☐	flesh	☐
	f) male cones are oval in shape	☐	ball	☐
	g) in spring, the female cones have a reddish-purple color	☐	marone	☐
	h) mature female cones are ovoid in shape	☐	ball	☐
	i) mature female cones are oriented on the branches upwards	☐	down	☐
	j) mature female cones are brown	☐	dark green	☐
	k) the cells of the cones open when the seeds are raw	☐	baked	☐
	l) cones fall in autumn	☐	spring	☐
seeds	a) under each scale, there are two of them	☐	four	☐
	b) have a square shape	☐	triangular	☐
	c) they are black	☐	marone	☐
	d) the fin has a light color	☐	closed	☐
General characteristics of spruce				
a) terrestrial plant	☐	aquatic	☐	
b) woody plant	☐	herbaceous	☐	
c) annual plant	☐	evergreen	☐	
d) it is a tree because a stem starts from the root	☐	more stems	☐	