Content:

Snails' form and structure

SPECTO Caracoles

Proyect DI 039.412/2021. Inside the shell: using augmented reality as a window into biodiversity

Project's Director
Cristian Merino Rubilar
Instituto de Química, PUCV

Contents development team
- Catalina Iturbe, Universidad Austral de Chile.
- Brant Miller, Universidad de Idaho
- Cristine Parent, Universidad de Idaho
- José Miguel Garrido, PUCV
- Andoni Arenas, PUCV

Graphic and technological development team
- Sonia Pino Espinoza. Ing. De proyectos
- Humberto Vergara. Desarrollador de aplicaciones
- Gonzalo Osvaldo Zavala Figueroa. Desarrollador de aplicaciones
- Eduardo Becerra Gamboa. Diseño de interfaz
- Centro Costadigital PUCV.

Presentation

Snails have occupied an important role in the ideology and religion of ancient american people, who considered them magical and used them in ritual ceremonies as ornaments, musical instruments and architectural elements. Today, they are a source of inspiration for poets and playwrights. For science, snails are a valuable study system to understand biodiversity and evolution. From a biological point of view, snails are of great importance due to their notable ecological and morphological diversity. Therefore, we are going to use snails and their shells to develop educational material to disseminate to citizens and teacher training. Given that many endemic snails are a source of concern for conservation, and most South American snails' species are not quite well classified, we must involve the public in general through a language that informs the importance of biodiversity. However, it is not possible to see the diversity of a species with a simple view. To promote the multiple faces of biodiversity, we are developing educational material supported in augmented reality to allow local communities to gain access to the knowledge of these organisms and their importance in the territory that they live in.

Introduction

The presented set of activities with immersive technologies of augmented reality looks to introduce us to the fascinating world of gastropods, or simply snails. But, why are snails important?

First of all, because of its place in trophic chains. Many birds, fishes and other species depend on snails as an important part of their diet. Most land snails' species consume fungi and leaf litter, helping decomposition, and lots are carnivorous, so they help maintain other species under control.

Second, their shells –that they carry along all of their lives, since they would die without them– are made of Calcium carbonate, which provides a record of their lives, and an indirect measure of the available Calcium in their habitat. Unlike vegetable peels or insect exoskeletons, these deposits tend to persist after a snail has died, leaving behind a valuable tool for researchers, searching for evidence of how the past ecological communities were, and hence, for evidence about climate change in a particular area.

Third, land snails often have requirements typical of a restricted habitat. They need certain moist levels, shadow and decomposed materials. When they do not have that they start to die. And that is just the beginning: if tiny land snails start to disappear, it is important to ask oneself what could happen afterwards. This could give us an opportunity to change course to detect subtle changes that human beings could not see until it is too late (Platt, 2016).

Fourth, several land snails' species live in little geographical areas, and since there are many species, it makes it fascinating to study how life on earth evolved.

Finally, snails are an important piece of the puzzle that makes the planet work. They are also a way to better understand how we have got here, and maybe where we are going to.

We invite you to understand a little bit more about snails, but above all, its interior… welcome.

More information in:

Platt, J. (2016). ¿Por qué debe importarnos que los caracoles estén desapareciendo? *Scientific American*. Acceso en: https://www.scientificamerican.com/espanol/noticias/por-que-debe-importarnos-que-los-caracoles-esten-desapareciendo/#:~:text=Muchas%20aves%2C%20peces%20y%20otras,mantener%20otras%20especies%20bajo%20control.

Target audiences

This material is designed for the development of the 4th year's learning objectives (LO) of the Chilean curricula (9-10 years old).

Learning objective	Description
Science LO 04	Analyze the effects of human activities in Chilean ecosystems, proposing measures to protect them (national parks, vetoes, among others).
History, Geography and Social Science LO 08	Describe different landscapes of the American continent, considering climate, rivers, population, languages, countries, and big cities, among other, using proper geographical vocabulary.
Technology LO 05	Use software to organize and communicate ideas and information with different purposes with: presentation programs to show images, diagrams and texts, among others; spreadsheets to organize data and draw simple charts.

ACTIVITY 1:
What do we know about snails?

Objective:
Student recognize snails as a living organism located in their close environment.

To initiate, look carefully at these riddles. Highlight those clues that allow you to predict who they are talking about.

"I go with my house in my shoulders, I go without legs, and I go marking my track with a silver string. Who am I?"

"I don't make a noise when I walk because I don't have legs, I have horns and I am not a bull, I don't get wet even when it rains, I never leave my house, even though my head sticks out. Who am I?"

"I am little and soft, I carry my house on my back. Who am I?"

"They find me on the beach, in the shadow and in the sun, my name has s and nail."

Next, we present you our "*black box*", you have to put your hand inside without looking what you are touching. Describe in your notebook what you think it is and which clues led you to infer what is inside the box.

From the previous activities, draw with as much details as you can the phenomena that we are studying. When the time is up, exchange your drawing with a classmate and write what you can understand from your classmate's drawing. Later, join other couples to comment on what you understood and discuss if your interpretations of your drawings agree or disagree, and if it does, in what. Then, answer the questions: **What can we observe in the snails' drawings? Which characteristics do snails have?**

Entrance ticket
Draw here…

Finally, with your teachers' help we invite you to download from *GooglePlay* and active the App in your tablet or smartphone "ai_caracol". Once you have installed it, point with the camera to this mark..

Next, form a group of 4-5 classmates and discuss and answer the following questions*:* ***What can we observe in the snails' virtual object? How is it related to your drawing and your classmates'? Which element of the virtual object catches your attention the most?***

Finally, revise your drawing in the entrance ticket. Then, draw again including all the adjustments that come from the conversation with your classmates and the interaction with the App.

Exit ticket
Draw here…

ACTIVITY 2:
Let's go snailin'!

Objective: analyze the organism snail and its different structures to comprehend its vital cycle.

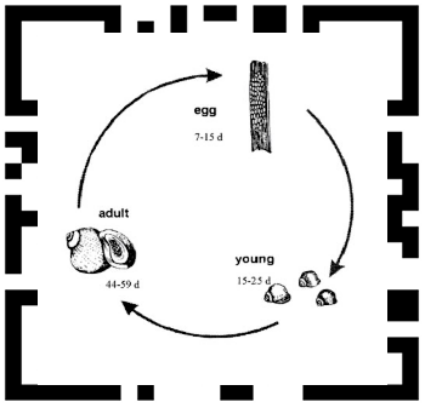
Maybe the land snails' world is a little unknown, and we can ask ourselves different questions, such as: Where can we find them? What do they eat? Do they sleep? How do they reproduce? We invite you to resolve some of these questions among others that we challenge you to formulate.

To give some answers to these key questions, we are going to do fieldwork. We are going to look in the school yard or in the school surroundings. For this, we need to systematize in an orderly fashion the snails' data that you manage to collect. The materials for this fieldwork can be: photographic camera or a cellphone camera, Vernier caliper or a ruler, tweezers, magnifying glass. With these instruments you can do quality observations, detailing the characteristics of the snails you have found and of the environment.

#	Date, time	Sample type	Width, height, diameter	Description of the place	GPS coordinates	Observations
01						
02						
03						
…						

With your teacher's help, we invite you to download from *GooglePlay* and activate the App in your tablet or smartphone "ai_caracol". Once installed in your device, select the recognition option and point to the snail with your camera. The App will allow you to recognize the species and will give you additional information, to complement your observations, answer the following questions: **Which snails are there? Where do they inhabit? From what do they feed from?** Note your observations in your notebook.

After the fieldwork, elaborate a description of the snails you have observed, socialize some of these descriptions in class, so we can collect some mutual elements in these descriptions, as in example characteristics such as: color, size, texture, where they are found, among others, and most important: **How is snails' life cycle?** We invite you to infer about a snail's life cycle. **How many years does a snail live? How does a snail reproduce? What does a snail eat? Which environmental conditions are important for a snail's life?**



Next, forma a group of 4-5 classmates and discuss and answer the question: **What can we highlight in the virtual object about snails' life cycle?**

ACTIVITY 3:
How is a shell from the inside?

Objective: modelate a snail's most important structures for comprehending the living organism interacting with the environment.

We are going to explore a snail's main structure, its shell. With your teacher's help, we invite you to download from GooglePlay and activate the App on your tablet or smartphone "ai_caracol". Once the App is installed on your device, select activity 3. Then, point the camera to this mark, observe, interact and use all the visualization options the resource offers you, such as rotate, zoom in, identify parts, etc. Subsequently, prepare to share your answers to the following questions: **Are all snails the same? How do we differentiate them? What do they have in common?**

Next in groups of 4-5 students, we are going to build a snail model. For this, the model has to give account of the snail's characteristics and its surroundings. We suggest materials such as: cellophane paper, absorbent sponge-type cloths, plasticine, cardboard, sheets of paper, cold glue, model sticks, among others.

Finally, each group has to explain in written in a paragraph a description of their model, that can be in this manner: This is a _____ (land/sea) snail, it inhabits in _____, where there are found _____. They eat _____ and need _____ to live.

Exit ticket
Explain your model here…

ACTIVITY 4

Are all snails the same?

Objective: Reflect about the snails as a biological species and the effect of human activity on it.

We are approaching to the end of our snailin' adventure, and it is time to resignificate what we have learned, individually or in a group. Now, lets locate in a map of our territory our samples to answer the questions: **Where do snails are located? From what do their location depend? Are they everywhere?**

Map	Description
Print, cut out and glue here a map of the zone where you collected your snails…	Describe here the places where you found snails…

To gather more information and compare your data, we invite you to visit the website http://iacaracol.pucv.cl where you will find photographs of other snails collected in different places of our country. This will allow you to complement your observations and answer the following questions: **What snails are there? Where do they inhabit? What do they eat?**

To end the activities, we invite you to answer two questions to self-assess what you have learned that can be discussed in a forum that allows you to exchange points of view with your classmates. The questions are: **(a) How do you think that human beings activities' affect the life and existence of snails?; (b) What would you do to preserve native snails?**

We invite you to draw a snail of your preference in the place it inhabits, with the answers to these final questions. These drawings can be shown in the classroom or to the school community.

FINAL CONSIDERATIONS

The teaching-learning sequence presented above constitutes a proposal that adequate differences contributions from science education to teach the relevance of snails as organisms that allow us to learn about biodiversity, as well as integrating technologies in this process, as augmented reality, to promote learning. The development of a modeling-inquiry sequence as the one designed, has the purpose of bringing opportunities to think about the world with theory, specifically in the 4th. grade and from an interdisciplinary approach. The latter shows the integrality of the proposal, lifted from a mapping that links biodiversity, immersive technologies and current school curricula. That is how the common points are found between the subjects of Science, History, Geography and Social Science and Technology; the effects of human activities in ecosystems are analyzed, taking into account the landscape description as a key element to comprehend the characteristics of the habitats and mediating the process with diverse technologies. All this, with the snails a key organism that connects these ideas and promotes the students' activity in the classroom.

For this sequence, we value the use of models and drawings as concrete models to stimulate the development of scientific explanations of the snail as an organism's surrounding phenomena, as well as also the models and drawings are used as a way of representation in relation with the everyday phenomena that are experimented in the own inhabited place, giving this way an added value to the place.

Finally, students' reflections are a window to the construction of new learning challenges from the school, through the dialog is possible to explore particular problems that are associated with the snails of the explored place, bringing the possibility this way, to star new learning cycles that add more phenomena and relevant situations, as well as in contextual as in theoretical means.