

Final Report

Communicating Boxes: An educational Project about Valdilecha's quarry



Communicating Boxes

1. Contestant profile

▪ Contestant name:	Manuela Salvado Muñoz
▪ Contestant occupation:	Biology teacher in secondary school
▪ University / Organisation	IES Poeta Claudio Rodríguez
▪ Number of people in your team:	7

2. Project overview

Title:	Communicating Boxes: an educational project about Valdilecha's quarry
Contest: (Research/Community)	Community
Quarry name:	Valdilecha (Spain)

Communicating Boxes

Abstract (max 0.5 page)

Communicating boxes is a project with two intentions. First, it attempts to relate the elements of the ecosystem, their functions, how humans use them and the improvement of the environment. Second, we want to relay information about sustainable mining.

Secondary students have prepared an exhibition material explaining the climatic and geomorphological characteristics of the Valdilecha's quarry, as well as the biodiversity plans in the flora and fauna that are being developed in it.

The materials produced have been exhibited in various educational centers as well as in public places, where the students themselves have explained fundamentally the biodiversity plans implemented in the Valdilecha's quarry.

Finally, we have been able to analyze the opinion of the varied public that has been able to see the exhibition entitled "Communicating Boxes", thanks to the collection of surveys before and after our explanations.

Communicating Boxes

Final report (max 9 pages)

Introduction

Objectives

1. Analyse the elements of an ecosystem and their relationships.
2. Assess the use of mining resources while respecting the model of sustainable development.
3. Design a communication model to explain biodiversity in quarries.
4. Develop an educational project in a team that allows students to be brought closer to real situations in today's society.

Team description: All of the participants of this project belong to the IES Poeta Claudio Rodríguez. All of the students of the Scientific Culture subject of 4th ESO and their teacher, as well as English, technology and plastic teachers who have collaborated in certain activities.

The project has been aimed primarily at the **educational community**, both primary and secondary schools, but has also reached another type of population of all ages.

Action plan

The project is divided into three phases:

1. Compilation of information.
 2. Preparation of communication materials.
 3. Divulcation and surveys.
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1. **Compilation of information.** A visit was made to the Valdilecha quarry, where we could observe the biodiversity plans applied in the same. But, without a doubt, our greatest research work and search for information was carried out with the help of different bibliographic sources, mostly through the Internet, regarding to:
 - a. Mineral resources, types of rocks and their uses in the Valdilecha quarry
 - b. Elements and dynamics of ecosystems, especially of the temperate grassland with arid Mediterranean climate and continental influence.
 - c. Biodiversity plans in flora and fauna developed in the Valdilecha quarry
 2. **Preparation of communication materials.** All the examined information has been represented in wooden boxes, on easels that will serve as a way of exhibition. The contents exposed in each of the ten designed blocks have been used to prepare a dossier (**Annex I**), which can be used by schools and by the company to publicize the way of working of this quarry.

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At the end of our project, explanatory videos have been prepared, which can be viewed on the following YouTube channel: <https://www.youtube.com/channel/UCfgtmtccKWFNYnqA34D5C3A>

The contents of the exhibition have been distributed as follows:

a. Geomorphology and climate “The Foundation of life”

The quarry of Valdilecha is located about 50 km south-east of Madrid. The company that manages the mining activity (Heidelberg Cement Group) is a pioneer in the application of biodiversity plans, which will be explained throughout this exhibition.

A biodiversity plan consists of analysing and studying the most important parameters of an ecosystem, which will allow us to understand its functioning. With this information, measures and strategies can be designed to achieve the potential functionality of the environment, as well as the monitoring of animal and plant species.

Our study begins with an analysis of the biotope. The climate and geomorphology will be analysed.

Regarding to the climate, we show a climograph made from average temperatures and annual rainfall, which shows all the biomes present in the biosphere. A biome is a region of the planet that shares climatic characteristics, flora and fauna. In Valdilecha the biome corresponds to the "Temperate grassland", with an arid Mediterranean climate and continental influence.

Respect to the geomorphology we represent a relief model of the area, elaborated from the topographic map of the municipality of Valdilecha. The geomorphological study is aimed at proposing biodiversity plans that reduce erosion and increase the fertile soil layer.

b. Uses of rocks “A way to improve our lives”

Do you know the fate of materials extracted in Valdilecha's quarry?

The predominant rocks in this quarry are sedimentary mainly clay deposits and **marlstone**, like that seen on the left side of the box. The materials belong to the Cenozoic era, Miocene period (covering from 23 million years ago until about 5 million year ago). A characteristic of this geological period fossil is **Planorbis** gastropod of continental environment may be seen on the right side of the box.

On the left (below) you can see three samples of material of different grain that will be used mainly for the manufacture of cement and other construction materials. With these materials, infrastructure can be built to improve our quality of life. On the right is a model of our institute, as an example of all those improvements that the quarry brings to our lives. The scale model of the IES Poeta Claudio Rodríguez has been elaborated by the students thanks to a 3D printer.

c. Trophic pyramid “A well-built diet”

After the study of the biotope (group of physical and chemical factors), we begin with the study of the biocenosis (group of living beings of the ecosystem). To do this, we represent a trophic pyramid of an ecosystem in equilibrium.

We propose a game, take all of the cards and put them on the correct trophic level. Follow the instructions:

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- First level, producers or autotrophic organisms (plants)
- Second level, primary consumers or herbivores
- Third level, secondary consumers or carnivores
- Fourth level, tertiary consumers or super predators.

At the end you can check your results with the image that is below the box.

d. The most common plants “A naturally diverse landscape”

Biodiversity plans in plants consist of reforestation with native species, since they are the best adapted to the climate and the biome in which they live, favouring ecological succession and increasing both food and shelter for other species.

In this box, we show the ecological succession by naming the most common Valdilecha species as you can see in the pictures.

First, the land begins naked and free of life. After 6 months, the mosses and lichens appear, after 1 to 2 years the herbaceous plants develop as the *Helycrisum* or curry plant, from 2 to 15 years the bushes appear as the *Quercus coccifera*, a slow-growing, evergreen kermes oak, and the esparto grass and in 15 to 80 years, oaks and a great diversity of other species are seen.

We have wanted to compare it with the growth of cities, which are increasingly more complex, energy and have more ecological niches.

Thanks to these biodiversity plans, we can shorten the time it takes the ecosystem to reach maturity.

e. Plants with medicinal uses “The natural first-aid kit”

Open the first-aid kit and watch.

The pictures, scientific names and most common uses of some of the plants that have helped people improve their health throughout history are shown on the doors of the first-aid kit. To do this, we have created this kit that symbolizes the medicinal uses of those plants.

The box is divided into two parts:

The part on the left represents some of the current medications.

The part on the right shows some of the most used plants for medicinal purposes in ancient times.

f. Invertebrates “Nature’s small workers”

Here we start with the animal's biodiversity plans. Some of the most important are the insect biodiversity plans, because the rest of the plans are directly or indirectly associated with them. The insects' principal function is to impregnate the plants with pollen grains or the dispersion of seeds. Therefore, these animals improve the plants development.

On this box there is an insect hotel to accommodate special guests: invertebrates. Here, we have tried to compare the function of insects with theater actors where insects are the protagonists and are carrying out pollination (in the first scene) and seed dispersal (scenic background).

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In the background image, the seeds dispersion are represented by “the Divine proportion”(8-5-2-2-1). This is very common in nature, for example the displacement of petals in a flower or the shape of snail’s shell.

Pollinators produce food and seed dispersers create new life for Valdilecha ecosystem and thus increase biodiversity.

g. Amphibians “Nature’s musicians“

An ecosystem is in equilibrium when it houses all types of animals. One of these types is amphibians. They regulate the population of invertebrates and are responsible for the sound landscape in the Valdilecha quarry one type of natural music. They only need our help creating ponds to facilitate their reproduction.

Among the numerous biodiversity plans, we have chosen two:

- We have, built a pond, so that amphibians can reproduce, can protect themselves and protect their offspring from their possible predators (birds and mammals)
- Also, we have built a bridge, which is located on the road that connects the quarry with the highway of Madrid, it protects the amphibians from the many trucks that transport the material extracted from the quarry.

The most abundant amphibian species in Valdilecha’s quarry is the Netterjack toad, and thanks to biodiversity plans it can live and reproduce.

Press the picture of the natterjack toad and listen; that is its sound. We can distinguish it from other species by its characteristic yellow stripe in the dorsal part of its body. The hind legs are shorter and tend to run instead of jumping or walking, which is why it is called a runner toad. (You can see in the image below)

h. Reptiles “Earth’s scaled insecticides“

This box shows the reptiles in Valdilecha. Unlike birds, reptiles have less importance in the ecosystem of the quarry, as it only has nine different species of reptiles such as snakes and lizards.

The title reflects the importance of insects in their diet, so the reptiles act as regulators of these. To illustrate the box, we have placed:

- a snake moult (snakes are unique reptiles that move the entire skin, to renew its scales and eliminate parasites),
- a model of a typical nest with lizard eggs (hard shell and amnion adapted to the arid climate)
- two lizard tracks; ocellated lizard (*Timon lepidus*) and Iberian wall lizard (*Podarcis hispánica*), on clay (in the center of the box, as well as their images below)

Regarding to biodiversity plans, reptiles are already adapted to arid climate such as the one presented by the quarry, so it is not necessary to produce big plans of biodiversity to facilitate their settlement. As an example of a possible biodiversity plan, we have modelled a stone heap. The stone heaps are structures made of stones in conical form that serve as a refuge for reptiles and other mammals, such as rabbits.

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i. Birds “The brush-strokes in the sky”

In this box, we represent the main characteristics of the birds present in Valdilecha. Most of the birds are of open areas (such as pasture) or scattered vegetation (olive groves, vineyards...)

The birds of the quarry are presented at all trophic levels. The goldfinch is a primary consumer, sand martins are insectivores (secondary consumers) and the Kestrel is a tertiary consumer.

To illustrate this box we have picked up and ordered the feathers of a Common Chaffinch, picked up a few pellets (of barn owl), and a skull and legs of a Common Chaffinch.

Given the importance of the birds in the biodiversity of an ecosystem, multiple plans have been developed to increase the number of these animals. Here, we represent two BPs: the first one is specific for sand martins, which make nests by digging on slopes of large inclination, as shown in the left corner of the box, so they are protected from any land threat.

The second plan focuses on the Kestrels and is called nesting box. With this plan, we favour the nesting within the enclosure of the quarry and its surroundings, as well as the regulation of micro-mammal populations.

j. Mammals “Invisible creatures of nature”

To finish with all of the biodiversity plans of Valdilecha quarry, we show those that apply to mammals.

Mammals, which are usually omnivores, occupy the highest parts of the trophic pyramid. Although these animals are difficult to see during the day, we have collected findings from the quarry such as bones, footprints and excrements belonging to them.

In addition, frequent mammals of the quarry are wild boars, micro mammals, such as voles or field mice, and bats, among others.

In the graph we wanted to show the predator-prey relationship of the fox and the rabbit, one of the most studied and important relationships among living beings, where the regulation of the population size is shown. Thanks to the biodiversity plans, it is intended to avoid the overpopulation of prey (in this case of the rabbit, in red colour) and the depopulation of predators (in this case of the fox, in blue), ensuring that these and other related species reach equilibrium.

3. Divulcation and surveys.

The last phase of our project has been to **disseminate the materials** produced. Sessions of 45-50 minutes have been designed in which a survey was carried out before and after the explanations. All of that has been done by the students of the team.

For the realization of the **surveys**, we used the Plickers application, which allows you to ask questions online and get the answers and results in percentage graphs, in real time. So we have been able to know at every moment the shortcomings of the public that attended the explanation, and thus be able to influence the topics of greatest interest. On the other hand, at the end of each exhibition we have received the valuation of both Valdilecha quarry work and our project.

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The exhibition has reached a large number of school children. We have been at Valdilecha school with a group of 50 students. The majority of students and teachers of our school have attended the explanatory sessions that have been done in the educational centre. The rest have been able to see the exhibition for the month of June, since these materials were exhibited in the hall of our school.

The **disclosure by press (Annex II)** has led to obtain news in the local newspaper, digital newspapers and a special education. Also the school magazine Valdilecha College made a review of our passage through its educational centre.

We have also made **publicity through social networks**. The creation of the YouTube channel, as well as the blog of the "quarry life award", has served to make our project known. So people who do not live in Zamora or who have not been able to get close to our educational centre have seen both the evolution of the project and the final result of it. We have also used Facebook, Twitter, Instagram and Whastapp to make our project known to a greater number of people.

But without a doubt, the participation of our project in the **public library's exhibition hall** has been the activity that has given us the most publicize. For a week (from September 10th to 15th) a large number of library users, as well as, primary school children visited the project. Week in which, we have increased the number of public votes. In addition, during these visits we have collected in a book of signatures the opinions of the assistants.

Discussion

We believe that the results of the project have been very satisfactory since we have achieved the objectives set. We emphasize that the team work of the students has been excellent and we have also managed to complete, in the established deadlines, the different phases of the project.

Since we do not know any other educational project of this kind, that has participated in this contest, we want to highlight that the involvement of secondary schools in this type of awards should be taken into account more. On the one hand, the students approach the social and labour reality, at the same time they learn the scientific methodology. On the other hand, it is possible for the educational community, science and companies (in this case the mining industry) to get closer to society.

Another aspect of great importance is that **other quarries can reproduce this project easily**. All the material elaborated in this work is easy to design, promotes creativity and can follow the following guidelines:

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1. Study of the geology and geomorphology of the area
2. Study of the climate of the area (climographs)
3. Study of the ecosystem of the area; representative flora and fauna
4. Description of the biodiversity plans applied in the quarry

Regarding the **evaluation of the project**, we have analysed the surveys carried out, with *Plickers*, before and after explanations. To do this, it has been valued:

- The degree of knowledge of biodiversity plans
- The work in Valdilecha's quarry (or a quarry that applies biodiversity plans)
- The work developed in our "Communicating Boxes" project

The **most significant result** has been the great difference in the valuation of Valdilecha quarry work, before knowing their biodiversity plans and afterwards. The valuation that the population gives to **the work of a quarry**, before knowing our project, was approximately 68% negative (bad or so-so), although necessary (80%) (Fig 3). However, after the explanations made by our team, the opinions changed, going to 76% good or very good (Fig 2) and 89% necessary or essential (Fig 4).



Fig.1 Before knowing our project

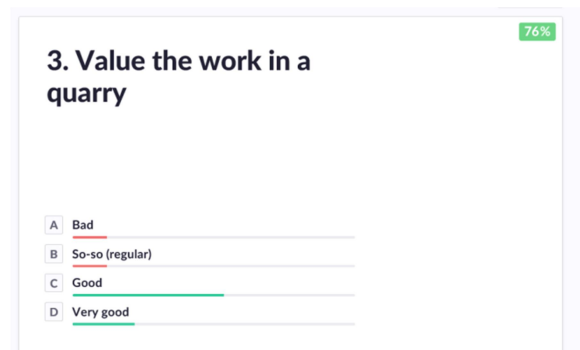


Fig.2. After knowing our project

In relation to **biodiversity plans**, we realized that most of the population has a great ignorance of them and we could also observe that the valuations in the quarry work changed. The groups, that already knew Valdilecha's quarry and its biodiversity plans, valued the work of the quarry in a similar way before and after knowing our project. Even so, there was always a small increase towards positive assessment.

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However, in the groups that were totally unaware biodiversity plans (most of the analyzed ones), they valued the work of a quarry very negative, before knowing our project, and very positive, after the explanations of the exhibition "Communicating Boxes". Therefore, we can say that the general public has a great ignorance of the work in a quarry that apply biodiversity plans, such as those of the Heidelberg Cement Group. However, when the population knows and understands the way of working that respects the environment, its assessment changes positively towards this type of industry. We realized that this was happening after visiting our exhibition.



Fig.3. Before knowing our project

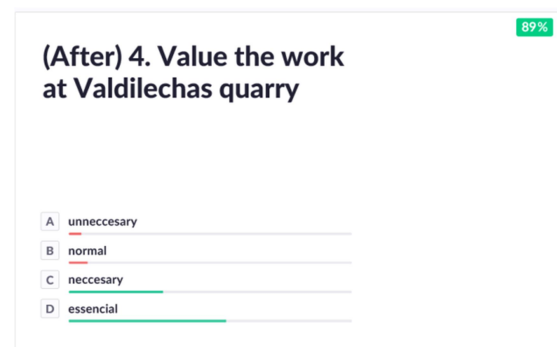


Fig.4. After knowing our project

In this case, we observed the difference between necessary and essential or indispensable, before and after explanations.

Finally, with respect to the **valuation of our project**, the **quantitative** response of the groups was a **90% excellent** (Fig 5) and the remaining 10% between good and remarkable. On the other hand, the **qualitative** assessment, analyzed by the comments written in the opinion book located in the exhibition hall of the Public Library, has been very positive, praising fundamentally the material designed, the easy understanding of the contents and the work of the students responsible for the project.

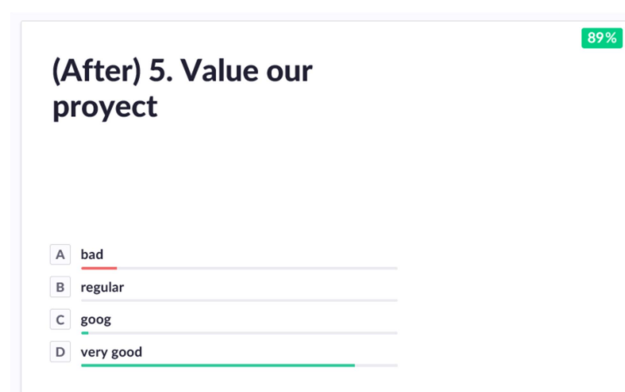


Fig.5. Quantitative valuation of our project

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Conclusion

Finally, we can conclude that the Communicating Boxes project has been very satisfactory due to the number of achievements got that are described below:

- We have managed to illustrate in a didactic way the biodiversity plans of the Valdilecha quarry.
- We have developed educational, scientific and informative material that can be used by both the educational community and the company.
- We have managed to get a large number of people of different ages to understand the work mode of the Heidelberg Cement Group, with regard to the application of biodiversity plans.
- We have designed a communication model that can be reproduced by other quarries of the company.
- We have observed that thanks to the contribution of our project the participating public has understood the way of working of the quarries that apply biodiversity plans, and also significantly modified its assessment with respect to this type of mining industry, becoming much more positive.

Therefore, we conclude by saying that our project has not only reached the objectives set, but has also allowed a group of 4th ESO students to learn to work as a team, to divulgate science and to respect the work carried out by the Heidelberg Cement Group.

Communicating Boxes

Annexes

Annex I Exhibition materials

Annex II Press Dossier

Communicating Boxes

Annex I Exhibition materials

Communicating Boxes: An educational Project about Valdilecha's quarry



Communicating Boxes

Annex II Press Dossier



Communicating Boxes



News in local newspapers; they shown the presentation of our project, both in our school (*IES Poeta Claudio Rodríguez*) as well as in the *Miguel de Cervantes* school in Valdilecha, on the occasion of the visit of the international jury.

Communicating Boxes



Cajas comunicantes = Communicating Boxes Un proyecto educativo sobre la biodiversidad en canteras

- Viernes, 07 Septiembre 2018 12:58
- Escrito por [J. Sánchez](#)



Cajas comunicantes es un proyecto educativo elaborado por un grupo de alumnos de 4º ESO del IES Poeta Claudio Rodríguez: Sara Avedillo, Adrián Berrocal, Ángel Guerra, Enola Lebrero, Aarón Tormadillo y Natalia Vega guiados por su profesora de biología Manuela Salvado. Fue diseñado durante el pasado curso escolar (2017-2018) para participar en los premios que organiza la empresa minera HeidelbergCement.

El objetivo de este concurso científico y educativo consiste en aumentar la concienciación sobre el valor orgánico de las zonas de extracción y compartir nuevas prácticas recomendadas por la comunidad científica, las ONG y las autoridades.

Nuestro proyecto valora los planes de biodiversidad desarrollados en la cantera de Valdelecha (Madrid), (única cantera que podíamos elegir para participar en dicho concurso); mediante el estudio los elementos más importantes del ecosistema de dicha zona.

La exposición que les invitamos a disfrutar pretende acercar el trabajo educativo a la sociedad, además de concienciar de la necesaria protección de la naturaleza mediante un correcto uso de los recursos. Al finalizar su visita podrán ver y escuchar las explicaciones de los propios alumnos responsables del proyecto así como alguna imagen del proceso de creación.

INAUGURACIÓN > LUNES 10 DE SEPTIEMBRE > 10:00 h

Del 10 al 15 de septiembre de 2018

Horario: lunes a viernes 10:00 a 21:00 h > sábado 10:00 a 14:00 h

Visitas guiadas por los propios alumnos > 12:00 y 19:00 h



Eugenio de Ávila

Oficial, 117 de Septiembre del 2018
BIBLIOTECA PÚBLICA

Cajas comunicantes = Communicating Boxes

Un proyecto educativo sobre la biodiversidad en canteras



Cajas comunicantes es un proyecto educativo elaborado por un grupo de alumnos de 4º ESO del IES Poeta Claudio Rodríguez: Sara Avedillo, Adrián Berrocal, Ángel Guerra, Enola Lebrero, Aarón Tormadillo y Natalia Vega guiados por su profesora de biología Manuela Salvado. Fue diseñado durante el pasado curso escolar (2017-2018) para participar en los premios que organiza la empresa minera HeidelbergCement.

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De la gravera a la Biblioteca

Alumnos del IES Poeta Claudio Rodríguez exponen su proyecto educativo "Cajas comunicantes"

A. A.
10.09.2018 | 21:32

Un instante de la inauguración de la muestra en
la Biblioteca Pública. Foto Emilio Fraile

A pocos días de comenzar sus
estudios de Bachillerato, los alumnos
del IES Poeta Claudio Rodríguez

Sara Avedillo, Adrián Berrocal, Ángel Guerra, Enola Lebrero, Aarón Tormadillo y Natalia Vega exponen en la Biblioteca Pública del Estado el proyecto educativo "Cajas comunicantes" con el que participan en el concurso científico The Quarry Life Award. Un certamen patrocinado por la empresa minera HeidelbergCement que tiene por objetivo aumentar la concienciación sobre el valor orgánico de las zonas de extracción y compartir nuevas prácticas recomendadas por la comunidad científica, las ONG y las autoridades.



Tras leer las bases de la cuarta edición del concurso, la iniciativa fue puesta en marcha durante el pasado año en el marco de la asignatura optativa de Cultura Científica en el centro zamorano. Seis alumnos, guiados por la profesora de biología Manuela Salvado, realizaron un exhaustivo análisis sobre la flora, fauna y clima de la cantera Valdelecha, ubicada en Madrid. "Nuestro proyecto valora los planes de biodiversidad desarrollados en Valdelecha, única cantera que podíamos elegir para participar en el concurso, mediante el estudio de los elementos más importantes del ecosistema de dicha zona", explican sus autores.

News in local newspapers, announcing
the Communicating Boxes project
in the exhibition hall of the public library