

Europeana Learning Scenario

Title

STEM with Camera Obscura

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Abstract

It's a STEM scenario which is inspired by the first vision recording (capturing image) device, Camera Obscura. It can be linked to the Physics curriculum in terms of its components. On the other hand, it is related to Chemistry and IT subjects in terms of light and photosensitive surface. Due to the similarity between the camera and eye, it can be correlated in Biology. The aim of the LS is to help students learn and understand the units, linking the device to the curriculum through observations and experiments. The LS does not mean that the Camera Obscura was created again by the students. The LS consists of four steps, one step includes Teacher's preparations before the lesson and the others consist of activities held during the lesson. The final activity is turning the classroom into the Camera Obscura.

Keywords

Camera Obscura, Physics, Chemistry, Biology, photography, photograph, STEAM, STEM, convex lens, optic, focus, mirror, plane mirror, imaging, photosensitive surfaces, vision, blueprint, diazotype paper, ammonia water, offset printing plate, CTCP, developer.

Table of summary

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Subject	Physics, Chemistry, Mathematics, Biology, Technology, Art, Industry
Topic	Learning by doing experiments and observations in Physics and Chemistry with the help of the Camera Obscura.
Age of students	15-18
Preparation time	2 hours
Teaching time	3 hours (45 minutes per lesson)
Online teaching material	Kapwing , Google Forms Making the Camera Obscura video
Offline teaching material	Cardboard box, aluminum foil (5x10cm.), packing tape, tracing paper (one sheet), mirror, convex lens, scissors, ruler, pasteboard, lighting, box cutter, latex gloves, Positive offset printing plate (CTCP), storage box, developer (for CTCP), diazotype paper, ammonia water, safety goggles, protective mask.



Europeana resources
used

[Image 1](#) [Image 2](#)

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Integration into the curriculum

- High school Physics lesson curriculum; light, optics, colors,
- Chemistry lesson curriculum; states of matter, solution, photosensitive surface,
- Biology lesson Curriculum; viewing.

Aim of the lesson

As for the Physics lesson, the aim of the lesson is to help students learn and grasp subjects such as light, optics, capturing view and viewing. Chemistry and Biology will be involved through experiments done with the help of the Camera Obscura which is the first device that captured view in history. At the end of the lesson students will be informed about the development process in the photographic technology and encouraged to do research.

Outcome of the lesson

Proving the rectilinear propagation of light. (Light spread in a linear way)

Learning the factors on which the focus distance of lenses depend.

Discovering new photosensitized surfaces.

Obtaining view on the photosensitive surface.

Capturing views through a pinhole.

Showing the relation between “Viewing through eyes and capturing an image with a camera”.

Trends

- Problem-Based Learning: Experiments, based on real life problems, were carried out here. Both the students and even the teachers didn't know about the outcome of the experiment. Photosensitive surfaces are known to be used in different fields, but they would be used on the Camera Obscura for the first time. They worked cooperatively.

- **Critical Thinking:** The students experienced the relationship between cameras with other disciplines. Hence, they tried to understand the relation among systems.
- **Collaborative Learning:** The students worked cooperatively during the process. They made some group work to work out the pose of the photosensitive surface.

21st century skills

Critical Thinking: In order to answer questions, students carry out studies on analyzing, synthesizing and classifying information. They search industries in which photosensitive surfaces are used. They experience the use of these surfaces in photography.

Creativity: Students try to find an answer to the question whether they can use different materials in a camera. Hence, the process requires creativity and innovation. They try to get a new and different point of view. They also find out the evolution of the mirror systems in cameras. They try to come up with new ideas which could be useful for others. After they have learnt about photosensitive surfaces, they try to create new ideas.

Activities

Name of activity	Procedure	Time
BEFORE THE LESSON (Pre-Lesson Preparations)	In this step, the teacher makes the Camera Obscura with the materials which were obtained previously. The teacher asks students to research materials with photosensitive surfaces. This research will be used in the chemistry part of the lesson.	2 hours
DURING THE LESSON	The teacher opens Camera Obscura images from the Europeana resources (image 1 , image 2). The teacher tells students that objects made of wood are the first camera in history. He says that he does not believe that an image will be obtained by using this device. That is why he says that he built this device by himself and shows students what he did. Finally, he motivate students to make observations and experiments by asking them if they want to give a try or not.	5' 5'
1st Section		

Name of activity	Procedure	Time
PHYSICS ACTIVITIES	Obtaining vision through a pinhole in the camera.	10'
	Obtaining vision through the convex lens.	10'
	Obtaining vision through the plane mirror.	15'
	The factors on which lens distance is based.	15'
	Observing the occurrence of view on the plane mirror, properties of view, learning the rules of reflection.	
	Lenses and application of focus distance measuring.	
2nd Section		
CHEMISTRY ACTIVITIES	States of matter (solid, liquid, gas) observations	10'
	Sharing information about the photosensitive surface.	15'
	The experiment of the view obtained by the Camera Obscura posing on the offset printing plate (CTCP)	10'
	The experiment of the view obtained by the Camera Obscura posing on diazotype paper (Blueprint)	10'
	The structure of the human eye and viewing process.	
	The similarities between the camera and human eye.	10'
3rd Section		
BIOLOGY, TECHNOLOGY, ART	The similarities between the Camera Obscura and modern cameras.	5'
ACTIVITIES	The experiment of turning the classroom into the Camera Obscura.	10'
	The painters reflecting their landscape paintings through the Camera Obscura on canvas.	15'
		5'
	Kapwing is a collaborative web 2.0 tool. Anyone who wants to contribute to the process may upload his / her videos and share them through this tool. (Those who are eager to implement the LS may add their own to the uploaded videos).	
	Video	

Name of activity	Procedure	Time
<p>The availability the other materials used for the LS were researched. Two experiments were planned for the Chemistry class, both of which were carried out successfully. One of the photosensitive materials is an offset plate used in printing, which is easy to find in urban areas.</p>		

Assessment

After the process, students are assessed with open-ended questions.

1. What are the features of the view on convex lenses?
2. What are the features of the view through the pinhole?
3. What are the similarities between modern cameras and the Camera Obscura?
4. What are the common features between the human eye and the view on the camera?
5. Give a few examples of photosensitive surfaces.
6. In what fields are photosensitive surfaces used?
7. What are the effects of liquid and gases on creating view on photosensitive surfaces?
8. Which arts have been related to the Camera Obscura?

***** AFTER IMPLEMENTATION *****

Student feedback

The students found the activities interesting although we didn't find the visuals interesting enough from the Europeana sources at first. I told my students that I had found such a device while surfing the [Europeana](https://www.europeana.eu) portal. I explained how I had managed it after I had searched for its history and learnt how to capture a photo with it. They found it quite interesting to obtain a reverse vision through the pinhole. Getting the view clearer with a lens made it more interesting. Finally, turning the classroom into the Camera Obscura carried their enthusiasm to the top. Since it wasn't clear and shiny enough, the view didn't appear. We tried it in another classroom with some better sunlight, but we couldn't achieve it, because the sunlight fell on the floor directly. After all, we tried in another room with no direct sunlight with a better angle and it worked. We can carry out the interactive optical experiment in GOLABZ, which offers various interactive experiments for different lessons. I also think that listening to the music band called Camera Obscura may enhance the motivation during the classes. By doing that, the teacher can refer to the relation between science and art.

Teacher's remarks

When the students saw the cartons first, they didn't pay much attention. Yet, they said that they found it very interesting during the process. It shocked them when the view appeared through the pinhole. It helped them participate in the process. They said that the experiment enabled them to relate the science to the real life. They also stated that the experiment would be useful for them to deal with real life problems and they would be more willing to create ideas about solutions.

About the Europeana DSI-4 project

[Europeana](#) is Europe's digital platform for cultural heritage, providing free online access to over 53 million digitised items drawn from Europe's museums, archives, libraries and galleries. The Europeana DSI-4 project continues the work of the previous three Europeana Digital Service Infrastructures (DSIs). It is the fourth iteration with a proven record of accomplishment in creating access, interoperability, visibility and use of European cultural heritage in the five target markets outlined: European Citizens, Education, Research, Creative Industries and Cultural Heritage Institutions.

[European Schoolnet](#) (EUN) is the network of 34 European Ministries of Education, based in Brussels. As a not-for-profit organisation, EUN aims to bring innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers, researchers, and industry partners. European Schoolnet's task in the Europeana DSI-4 project is to continue and expand the Europeana Education Community.

Annex

If you need additional information about the scenario, you can reach detailed drawing and information via the link below.

[Guide Booklet link](#)

You should definitely see the [GOLABZ](#) pages with interactive observations and experiments.