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# **How to improve the image of a camera obscura (pin-hole camera)**

- an inquiry-based approach from the middle school optics curriculum.

## How to improve the image of a camera obscura



## How to improve the image of a camera obscura

Physics curriculum for 12 to 13 year-old students in Lower Saxony:

Phenomena orientated optics:



images of ...

... a camera obscura and

... a photo camera

## How to improve the image of a camera obscura

### Students' pre-knowledge

Geometrical optics:

emitter-receiver concept of light

light and shadow

linear propagation of light

basic idea of a camera obscura











How to improve the image of a camera obscura

**(Students' pre-knowledge)**

camera made of a crisps can



**How can you improve the image of  
a camera obscura  
?**

## How to improve the image of a camera obscura

The students are asked

- to **form groups** and
- to **develop ideas** to improve the image of the camera obscura,
- to **write them down**,
- possibly to **plan the technical realization** and
- to **test them** in experiments.

## How to improve the image of a camera obscura



## How to improve the image of a camera obscura



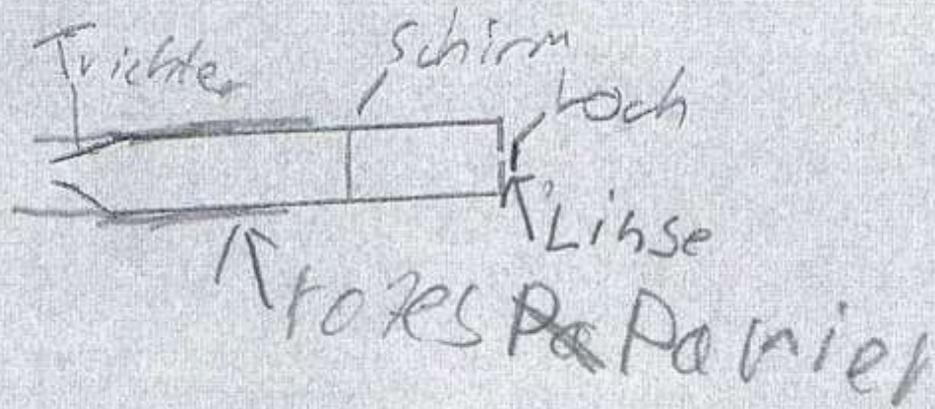
## How to improve the image of a camera obscura



## How to improve the image of a camera obscura

- Trichter auf die Öffnung
- Licht ausgrenzen

**Put a cone on the back to eliminate (interfering) light**



## How to improve the image of a camera obscura



**Better definition,  
more intense colours  
of the image**



## How to improve the image of a camera obscura

etly { Loch am Bodendeckel vergrößern.

onac  
M. { Begründung:  
Durch das größere Loch kommt  
mehr Licht hinein, deswegen sieht  
man es größer, farbiger und  
~~schärfer~~, unschärfer  
David Resultat: +

**Enlarge (central)  
hole on the front**

Reasons (and results):

The larger hole lets in more light, so **the image becomes larger, more colourful and more-less defined.**



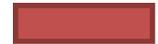
## How to improve the image of a camera obscura

**Additional holes on the front (more light), enlarge the central hole**

Löcher vorne am Rand (bessere Lichtquelle)  
4. Loch größer machen



**Image is brighter, but completely blurred.**



## How to improve the image of a camera obscura

The inside of the tube white instead of black  
(because black swallows all colours!)

Take a thinner screen

Put a tube (between the lamp and the hole)  
for concentrated light

transparent sheet instead of sandwich paper

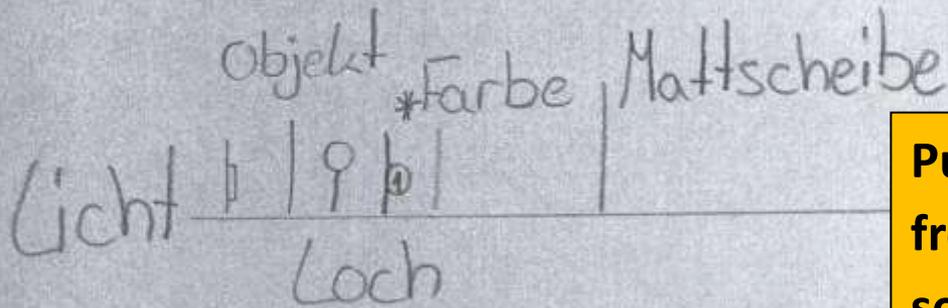
After we shone light on a teddy  
bear, its image was much brighter.

Let water drip  
on to the object

Mount a lamp on the  
front of the camera for  
more light

## How to improve the image of a camera obscura

(3.) Man stellt eine Lupe vor die  
Mattscheibe.



Put a lens in  
front of the  
screen

\* Die Farbe muss nicht sein.  
① Linse

Better definition,  
brighter image



## How to improve the image of a camera obscura

### **Continuation:**

- **experiments with convex lenses**
- **construction of lens images**

## How to improve the image of a camera obscura

### Experiences

- **high motivation**
- **variety of different ideas**
- **more room for creativity**
  
- **importance of documentation**

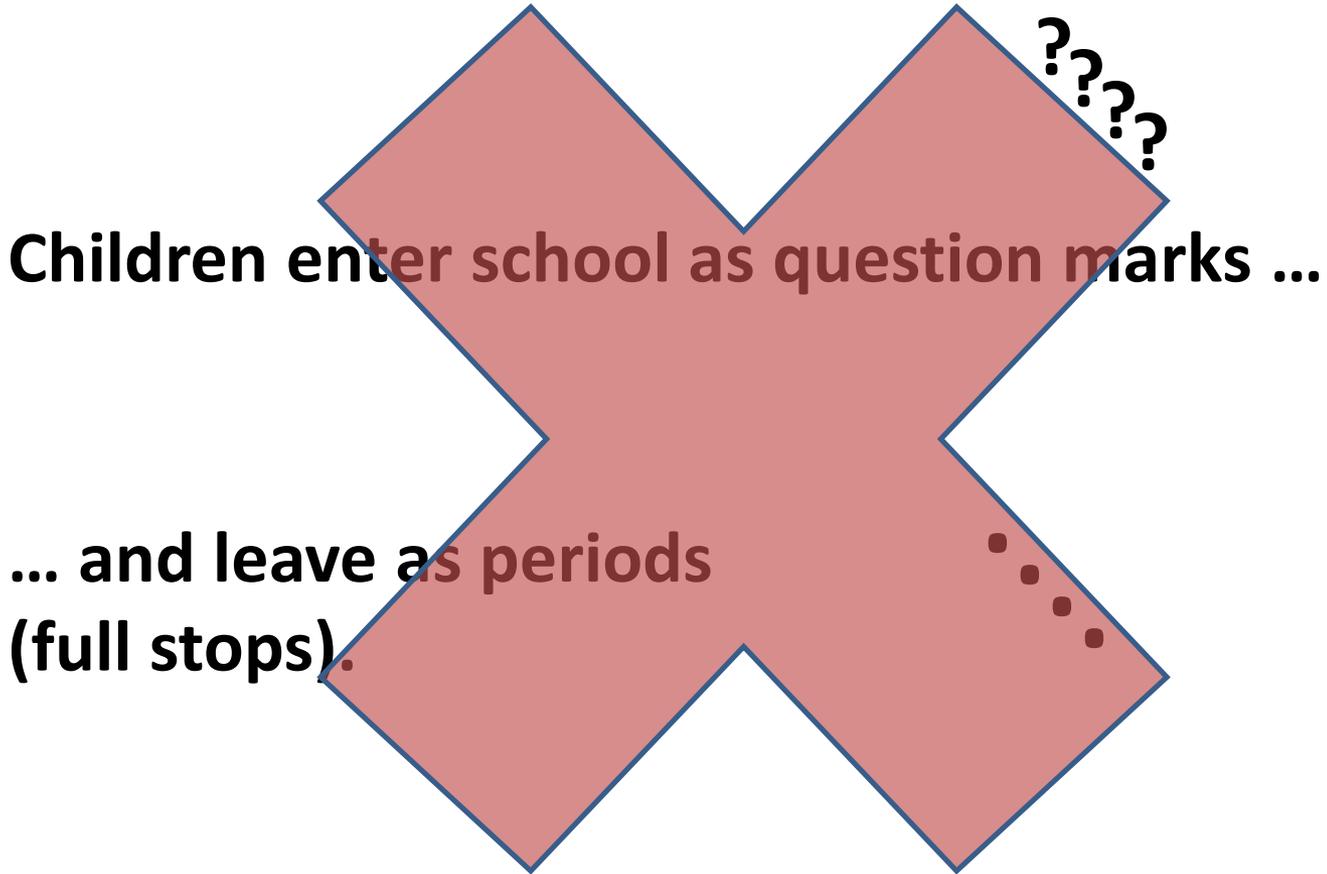
## **How to improve the image of a camera obscura**

### **Conclusion**

**We found that our inquiry-based learning sequence can open up the process of conventional tuition in a positive way.**

**Based on a subject of the current curriculum it can be very easily integrated into a conventional physics course.**

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(Neil Postman)