Sensor Starters

Grades: 4 & Up
Time: 15 Minutes -PDQ 1 & 2

Subject: Physics, Technology, STEM
Topics: Ambient Light, Illuminance

Meet the Light Sensor!

Light sensors measure **,** which can be used to measure more than the brightness of a light source. Do you have solar pathway lights that come on at night? Have you noticed the streetlights coming on at dusk? These are all controlled by a light sensor that turns things on and off based on the light conditions. Cool!

Background

Illuminance, a measure of light on a specific area, is different from light intensity which measures the light level at the source. For example, a light bulb intensity is measured at the bulb, but if you're on the other side of the room, the amount of light on you, the "," is much less as the light is obstructed and scattered by obstacles and distance.

Light is made up of tiny particles of energy called photons. Imagine these tiny particles streaming from a light source and bouncing off a device (it's called a diode) that senses them. The more photons that strike the diode the more electrical current is generated. This current is then measured and converted in to numbers.

Symbol for a photodiode.

Photons coming in hot!!

What You Will Need/Prep

- databot™ & Vizeey™
- IOS/Android Smart Device
- Use Vizeey to scan the QR Code for Illuminance.
- Light source

The light sensor is just one sensor in a module which is located top center of your databot. It is a multifunction module that also senses color, gesture, and proximity! Look for the label "light,"

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Important Terms

Illuminance: The measurement of the amount of light falling and spreading over a given surface area.

Luminance: Amount of light emitted by the source.

Lumens: The measure of the brightness of the light source in terms of energy being emitted.

Lux: A unit of light measurement where the area is taken into account.

How do we measure Light?

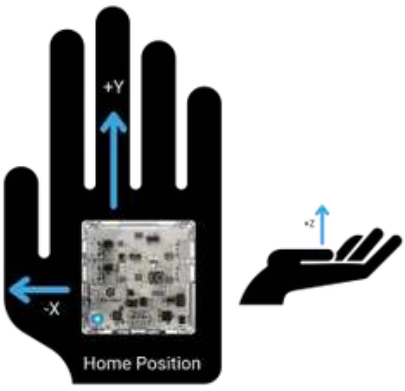
Lux is a unit of light measurement where the area is also taken into account. In other words – light intensity over a specific area which is . **Lux** is used to measure the amount of light output in a given area. Here are some examples of in different environments

Condition	Illuminance (lux)
Full Daylight	10,000 - 16,000
Indoor Classroom	300 - 700

Exploration Preparation!

In the coming activities you will be exploring your local environment and identifying levels using databot. databot is loaded with sensors and capabilities and it helps to have a common orientation for holding it and conducting experiments. That way if you are communicating with a partner you can communicate clearly - moving left, moving right, etc.

"Home position," shown here, is holding databot flat in the palm of your hand with the power and programming port oriented to the back of your palm. In this position sensors are facing up and you can move freely in any direction.



databot in "home position"

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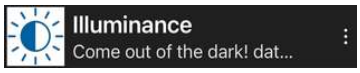
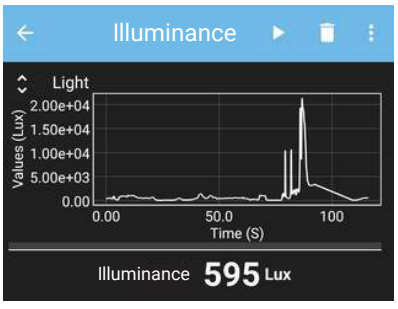
PDQ1 : High Lux, Low Lux!

Use the databot light sensor to explore in your room! Find the brightest and dimmest spots in your room and record the value along with the location. Be precise in your language and your data collection as you map . Good luck.

- Open the Vizeey App on your smart device
- Turn on databot.
- Tap on "**Illuminance**" *in* Vizeey™ to load the experiment. 

- Hold databot in the palm of your hand in "home position."
- Start your and pause your experiments using .
- Explore the room with databot trying to find the highest level of in the space.
- Record the / **lux** value and the location that you determine is the brightest.
    - Between locations, stop and clear your data using before moving on to the next location.
- Next, seek the dimmest spot in the same fashion.
    - Consider why some areas are dim and others are bright
    - Do you see obstacles blocking the light?
- Record the / **lux** value and the location you determine is the dimmest.

Location	Lux Level



Examples of in different locations in a room.

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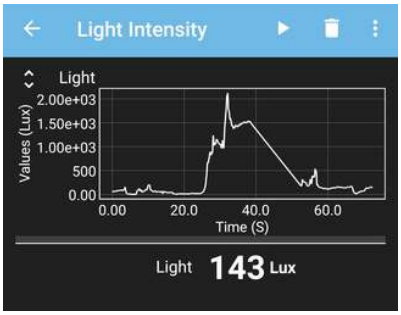
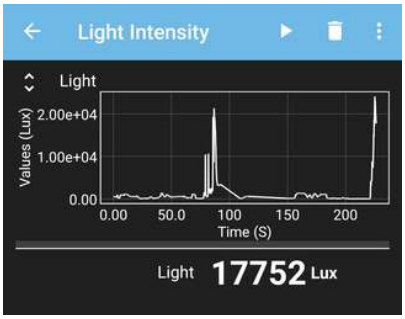
PDQ2 : Illuminance Vs Distance

In PDQ 2, use the light sensor to visualize and record how varies as you move away from a light source. With databot in your hand move away from a fixed light source. Use a tape measure to mark the distance. What is the **lux** value when the distance is 100 cm? How much does it vary from the value at 20 cm?

- Open the Vizeey™ App on your smart device.
- Turn on databot.
- Tap on "**Illuminance**" *i*n Vizeey™ to load the experiment.
- Start and pause your experiments using :
- Set up the minimum distance of 20cm between the light source and databot.
  - with databot in the "home" position point towards the light source and record the /**lux** value.
- Between locations, stop and clear your data using before moving on to the next location.
- Now, increase the distance between the light source and databot by 20cm.
  - Record the /lux value. Continue the same process till reaching the distance of 100cm.

Location	Lux Level
20 cm	
40 cm	
60 cm	
80 cm	
100 cm	





Examples of different distance measurements

Check for Understanding

1. In your own words, explain the difference between **illuminance** and **luminance**.
2. What are the units used for expressing levels of light ?
3. What happens to levels as you move further from a light source?

Standards & Alignment

NGSS Standards

- 4-PS4-2: Developing and Using Models
- 3-5-ETS1-3: Planning and Carrying Out Investigations
- MS-PS4-2/HS-PS4-3: Waves and Their Applications in Technologies for Information Transfer
- MS-ETS1-3: Analyzing Data
- HS-ETS1-3: Analyzing Data

Science and Engineering Practices

- 1st Practice: Asking Questions and Defining Problems
- 3rd Practice: Planning and Carrying Out Investigations
- 4th Practice: Analyzing and Interpreting Data
- 6th Practice: Constructing Explanations and Designing Solutions
- 7th Practice: Engaging in Argument from Evidence

TEKS -Texas Essential Knowledge and Skills

Elementary Process TEKS

- 5.2C Scientific investigation and Reasoning: Collect and record information
- 5.2D Scientific investigation and Reasoning: Analyze and interpret information to construct reasonable explanations.

Elementary Level Content TEKS

5.6C Force, Motion and Energy: Demonstrate how light travels

High School Level Process TEKS

P.2J Scientific Investigation and Reasoning: Express relationships among physical variables quantitatively, including the use of graphs, charts and equations.

P.2F: Scientific Investigation and Reasoning: Collect and organize qualitative and quantitative data and make measurements with accuracy and precision, using tools such as data collecting probes.

High School Level Content TEKS

P.8A Physics: Describe the dual nature of light.

Crosscutting Concepts

- Patterns
- Cause and Effect
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter

Disciplinary Core Ideas

- Wave Properties (PS4.A)
- Engineering, Technology, and Applications of Science (ETS1.B)
- Earth and Space Sciences (ESS3.B)

ISTE Standards

- 1.1 Empowered Learner (1.1.d)
- 1.3 Knowledge Constructor (1.3.a) (1.3.b)(1.3.d)
- 1.4 Innovative Designer (1.4.a) (1.4.b)
- 1.5 Computational Thinker (1.5.a) (1.5.b)
- 1.6 Creative Communicator (1.6.a) (1.6.b)