

ASSESSMENT OF SELECTED  
BIOLOGICAL ACTIVITY BASED ON  
INQUIRY AT LOWER SECONDARY

# Conditions

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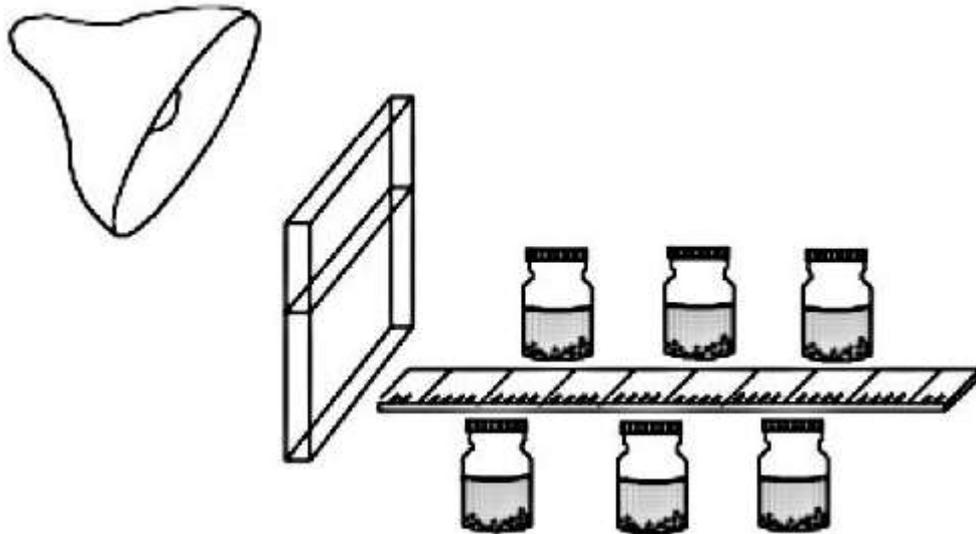
- Pupils aged 12-13
- Two lower secondary schools
- Groups of three - four pupils
- Classroom, laboratory is not required

# Our inquiry activity

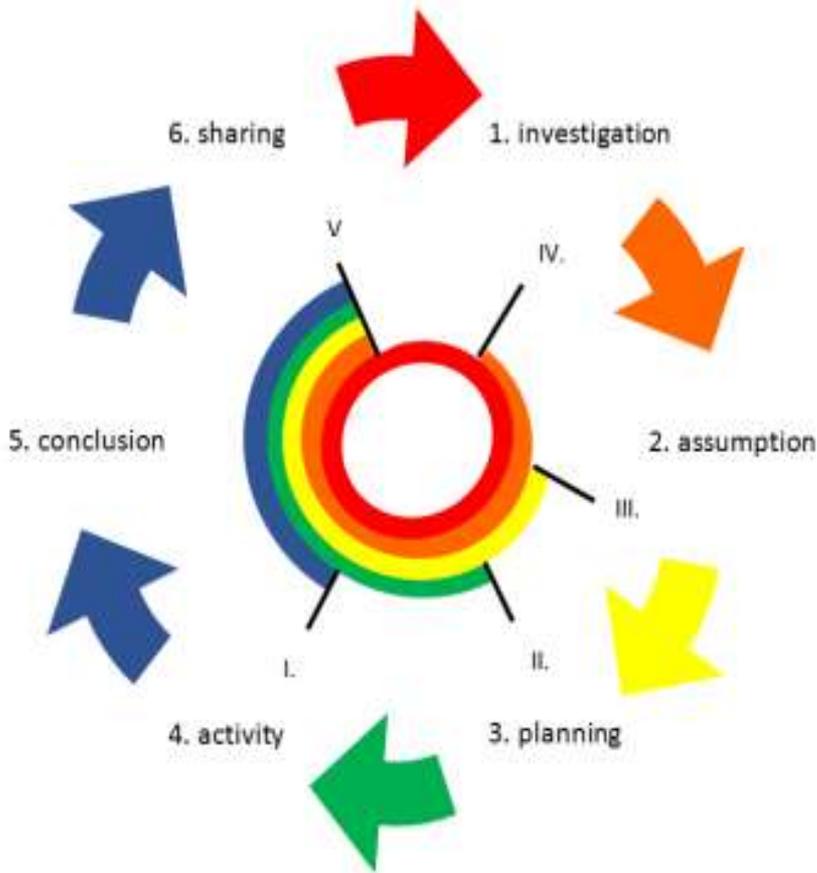
- **Plant nutrition, photosynthesis in algae**
- modelling the effect of light intensity on photosynthesis in green algae
- immobilizing some algae, making jelly algal balls
- determining the rate of carbon dioxide absorption by using hydrogen carbonate indicator

# Goals of activity

- Investigate how light intensity affects the rate of photosynthesis by using immobilised algae
- Assess the process of investigation



# Traditional inquiry model related to our inquiry cycle



/K. Kimáková/

- I. interactive demonstration
- II. guided discovery with instructions
- III. controlled /guided/ inquiry
- IV. bounded inquiry
- V. open /free/ inquiry

# Assessment of IBSE activity

Assessment of selected three key – moments *of inquiry planning*:

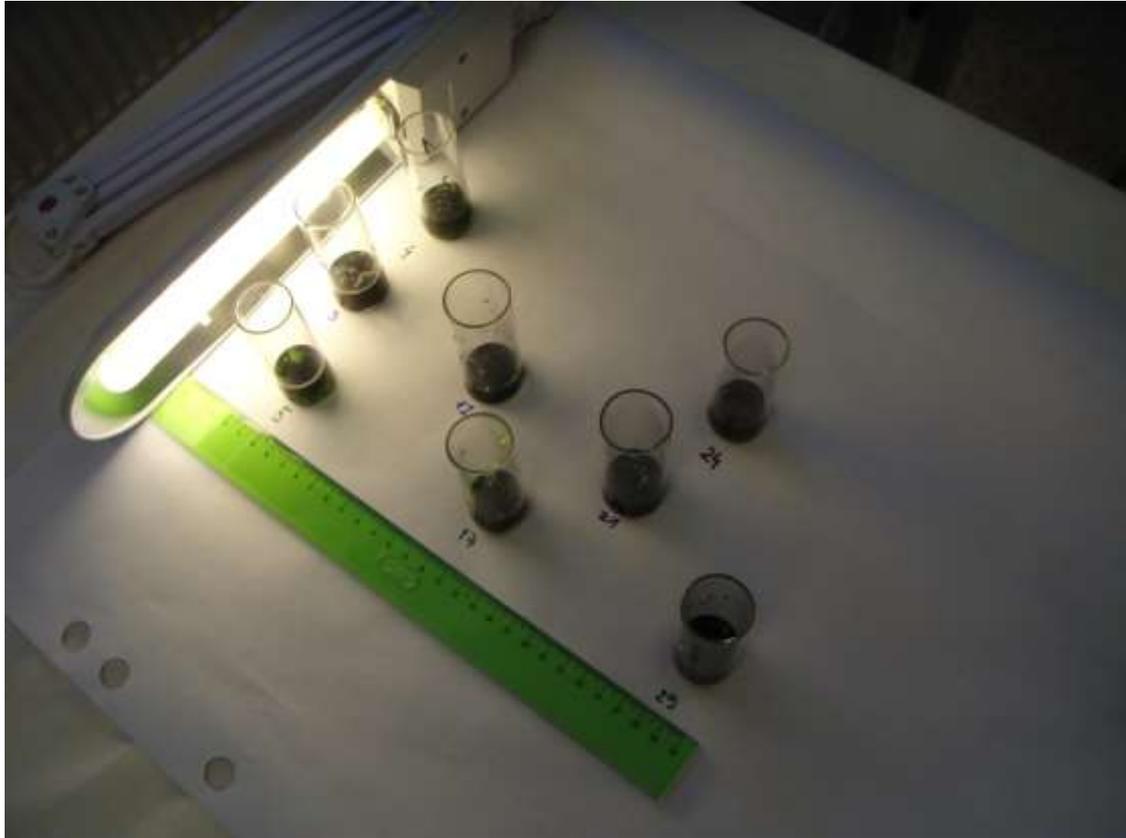
1. Distribution of algal balls
2. Layout of samples
3. Recording of constants and variables

# 1. Distribution of algal balls equally into three experimental containers

- a spoon
- a laboratory weighing scales - weighed three times the same weight
- volume using measuring cup



## 2. Setting up algal balls at different distances from the light



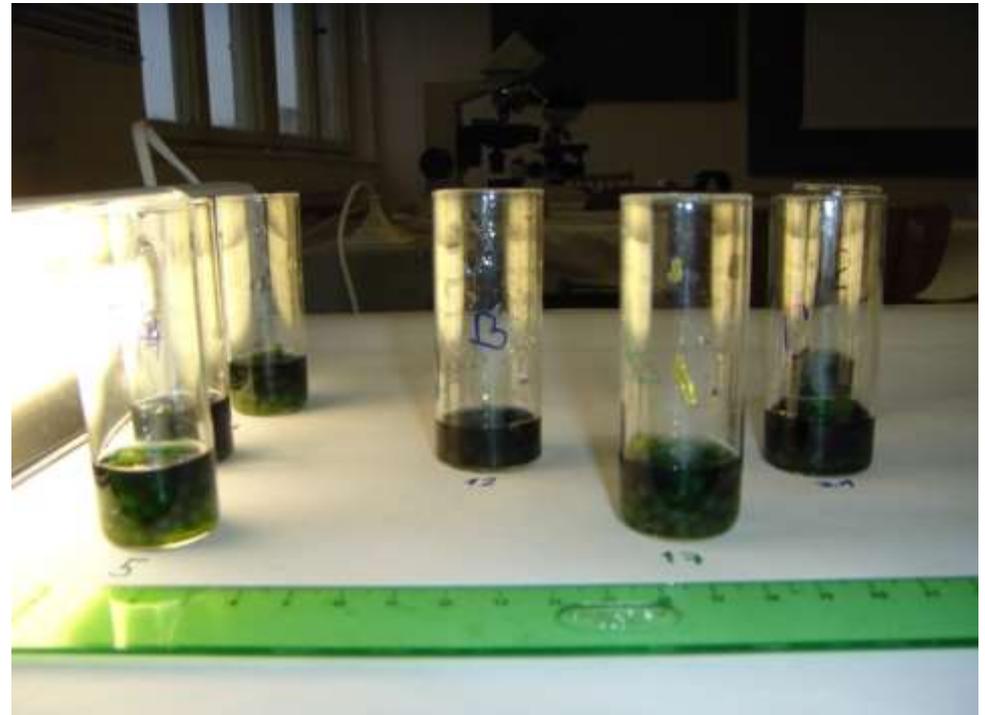
Students chose appropriate locations alone after discussion.

# 3.Entry of constants and variables

Groups discussed which data should be recorded



Volume of added indicator



The distance of sample from the lamp

# How were the skills assessed?

- Providing feedback through discussion

## 1. Distribution of algal balls

*choice of method of distribution and justification*

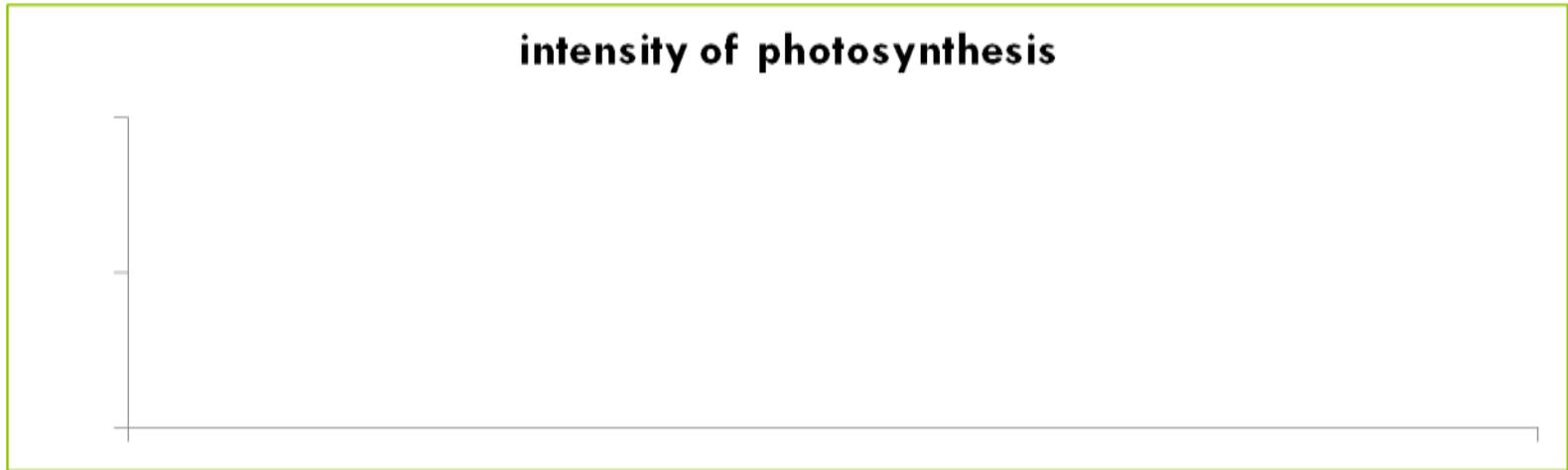
## 2. Location / layout/ of three samples

relationship of distances from light and photosynthesis

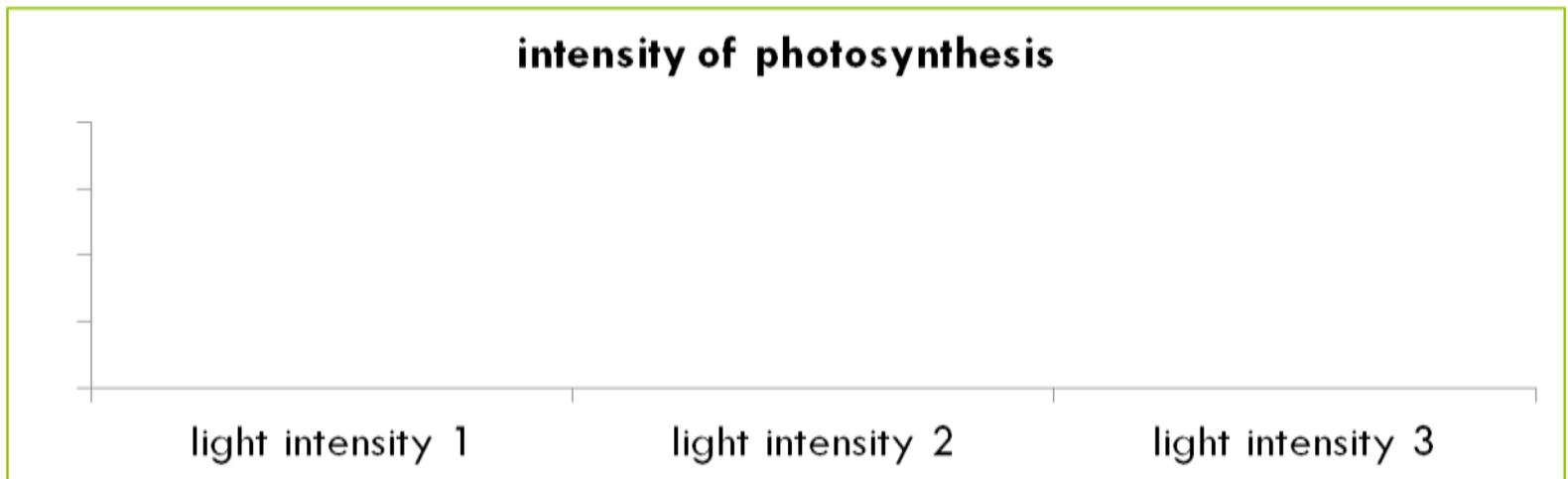
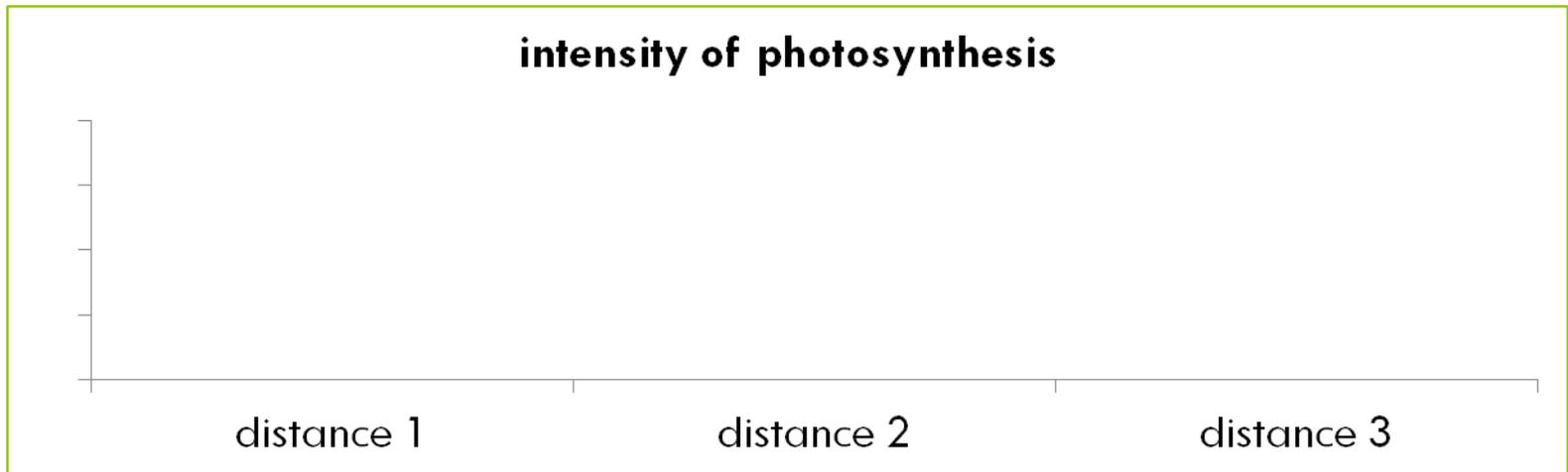
## 3. Data presentation

*organize the data entry in table or graphs*

# Proposal of a draft graph



# Proposal of a draft graph for younger children



# Tasks in the worksheet:



- How does the colour of the indicator relate to the amount of carbon dioxide?
- In which of the samples was there the most intense photosynthesis?

# Students' conclusions

*Students understand changes of indicator colour as a variable dependent on the distance of the sample from the light source.*

We missed:

- explanation of the relation of colour change to the change in CO<sub>2</sub> concentration
- accurate explanation of the relationship between the intensity of photosynthesis and the colour change of the indicator

# Students' output

LABORATORNÁ PRÁCA

potrebné pomôcky: pipeta, plastový pohár, kádinka, silikón, lyžička, sekera, nádobky

postup: Z riasy sme pripravili pipety vyfúkli guľôčky ktoré sme nabalali do kádinky s vodou. Silikón sme pridať voda kádinky sme dali guľôčky do vody. Každú lyžičku sme šetrne vyložili a mät, ktoré guľôčky "dobre" s ktorými nádobky = každý mal rovnaký počet

výsledok: V každej z n. skúmaviek mala byť 6 ml guľôček

záver: Sme do skúmaviek našli vyfúkné rovnako množstvo guľôček. Každá guľôčka má rovnaký perimetriálny rozmer, aby mohla vojsť do skúmavky. Celá skúmavka - množstvo vody nádobky 7.4 a skúmavka - 5cm. Vzdialenosť medzi nádobkami 2.2 a skúmavka - 5.0cm. Vzdialenosť medzi nádobkami 2.3 a skúmavka - 9.9 cm. Množstvo sme ich takto označili.

výsledok: Každá skúmavka bola odobrá, mali guľôčky s kádinkami inu kádinky. Každá guľôčka bola najväčšie kádinky (sme sme nádobky 2.0) bola najväčšia. Keď sme pipety vyfúkli, guľôčky boli najväčšie - najväčšie 2.0 bola najväčšia. Keď sme nádobky odobrali a pipety vyfúkli, guľôčky boli najväčšie. Nádobky = 2.0 sa najväčšie guľôčky s kádinkami kádinky.

záver: Množstvo guľôček je 6 ml. Každá guľôčka mala rovnaký perimetriálny rozmer. Každá guľôčka mala rovnaký perimetriálny rozmer. Každá guľôčka mala rovnaký perimetriálny rozmer.

postup: Tmavú riasu sme si pripravili do kádinky. Každú guľôčku sme si pripravili do kádinky. Každú guľôčku sme si pripravili do kádinky. Každú guľôčku sme si pripravili do kádinky.

záver: Každá guľôčka mala rovnaký perimetriálny rozmer. Každá guľôčka mala rovnaký perimetriálny rozmer. Každá guľôčka mala rovnaký perimetriálny rozmer.

Writer of the group - 12 year old pupil - doesn't create a table for data display.

A similar method of recording was also used by pupils from different groups in their presentation, which they created at home.

**Zápis výsledkov pozorovania:**

Hmotnosti materiálov:  
 $m_1 = 21,7 =$  hmotnosť každej skúmavky s tuhým alginátom vápenatým.  
 $m_2 = 17,8 =$  hmotnosť jednej skúmavky

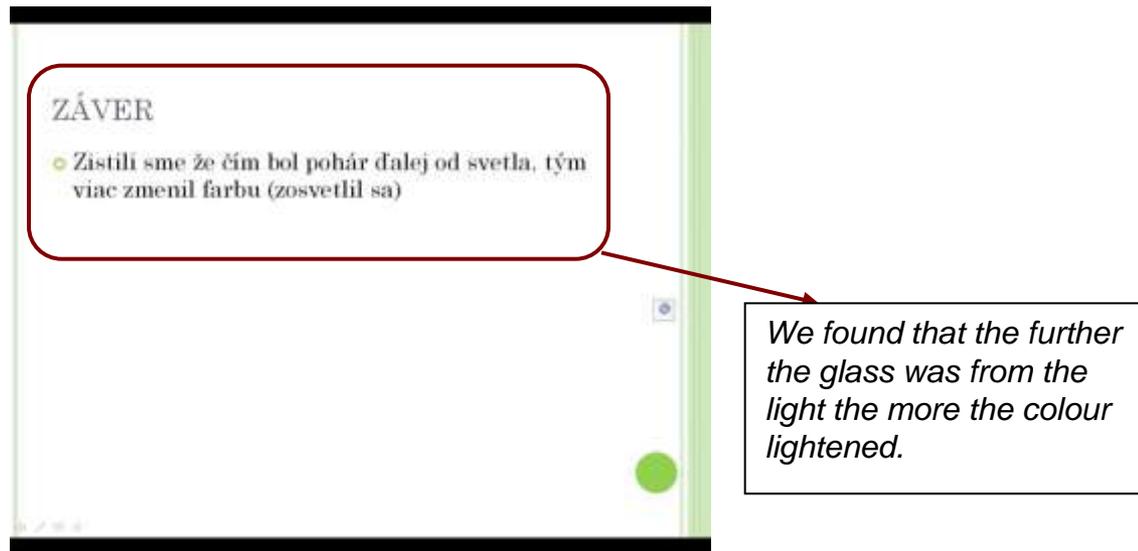
Vzdialenosť skúmaviek pred viditeľným svetlom.

1	2	= 46,5 cm.
2	3	= 46,6 cm.
1	3	= 93,1 cm.

Objem CaCl<sub>2</sub> v každej skúmavke.  
 =  
 6 ml



# Conclusion of one of the groups



The image shows a screenshot of a presentation slide. The slide has a white background with a black border. At the top, the word "ZÁVER" is written in a serif font. Below it, there is a bullet point in a sans-serif font: "Zistili sme že čím bol pohár ďalej od svetla, tým viac zmenil farbu (zosvetlil sa)". A red rounded rectangular callout box is drawn around this text. An arrow points from the bottom right corner of this callout box to a separate white rectangular box with a black border. This box contains the English translation: "We found that the further the glass was from the light the more the colour lightened." The slide also features a small blue icon and a green circle in the bottom right corner.

ZÁVER

- Zistili sme že čím bol pohár ďalej od svetla, tým viac zmenil farbu (zosvetlil sa)

*We found that the further the glass was from the light the more the colour lightened.*

Students' formulation of the conclusion.

# Criteria for judging assessment data

skill	Emerging	Developing	Consolidating	Extending
Planning an investigation				
1. Distribution of material	Indicates chosen method	Indicates chosen method and argues its speed	Indicates chosen method and argues its accuracy	Indicates and compares speed and accuracy of chosen method
2. Layout of samples	Procedure precise, but small distances between samples (10cm)	The layout is less accurate, time is recorded	Able to reason the procedure in practical terms	Able to reason the procedure, builds on the fundamental of photosynthesis
3. Data entry	Data recorded into a continuous text of process	Distinct process and results	Distinct process and results, accurate data entry	Recording data about colour of samples and their distance from the light in pupil designed table

# Conclusion

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- controlled inquiry
- assessed pupil's skills (participating in planning an experiment, activity during the course of the experiment)
- ability to collect data
- making solid conclusion

# Our insights

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- Double period of biology – long time of exposure to indicator
- Worksheet for students
- Draft graph

# Students' experience



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- Thank you for your consideration