

ASSESSMENT OF SELECTED
BIOLOGICAL ACTIVITY BASED ON
INQUIRY AT LOWER SECONDARY

Conditions

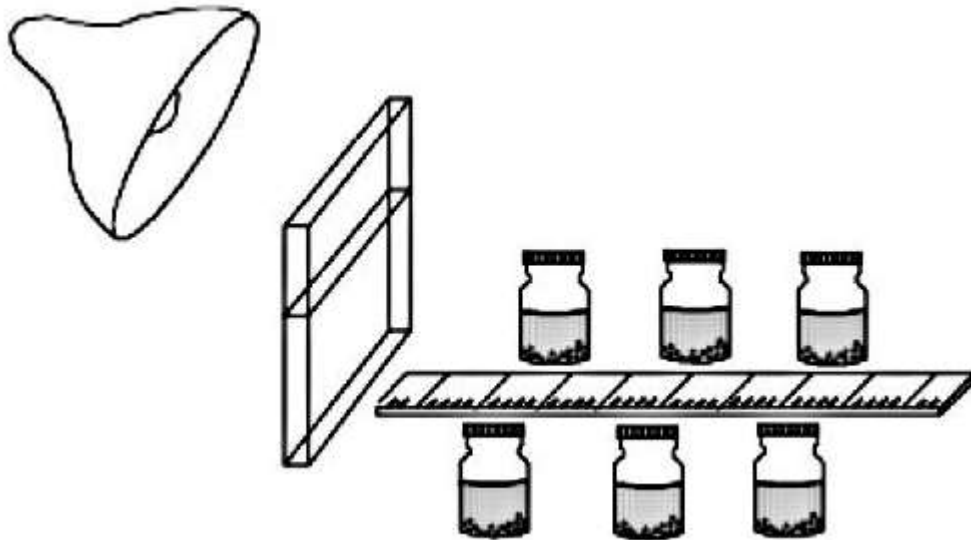
- Pupils aged 12-13
- Two lower secondary schools
- Groups of three - four pupils
- Classroom, laboratory is not required

Our inquiry activity

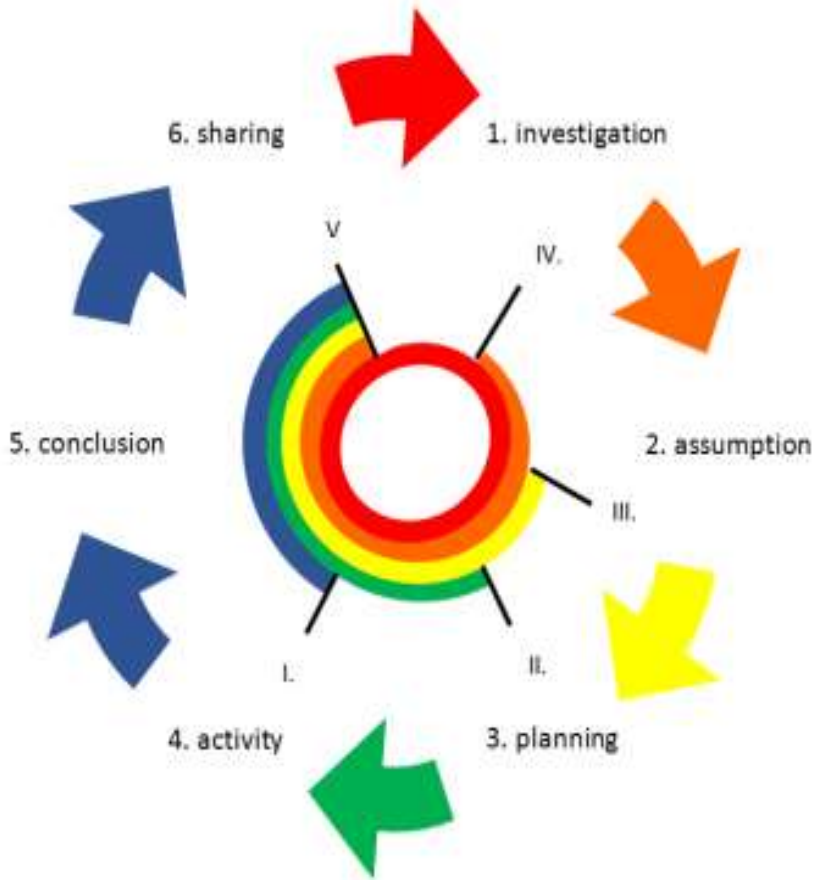
- **Plant nutrition, photosynthesis in algae**
- modelling the effect of light intensity on photosynthesis in green algae
- immobilizing some algae, making jelly algal balls
- determining the rate of carbon dioxide absorption by using hydrogen carbonate indicator

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



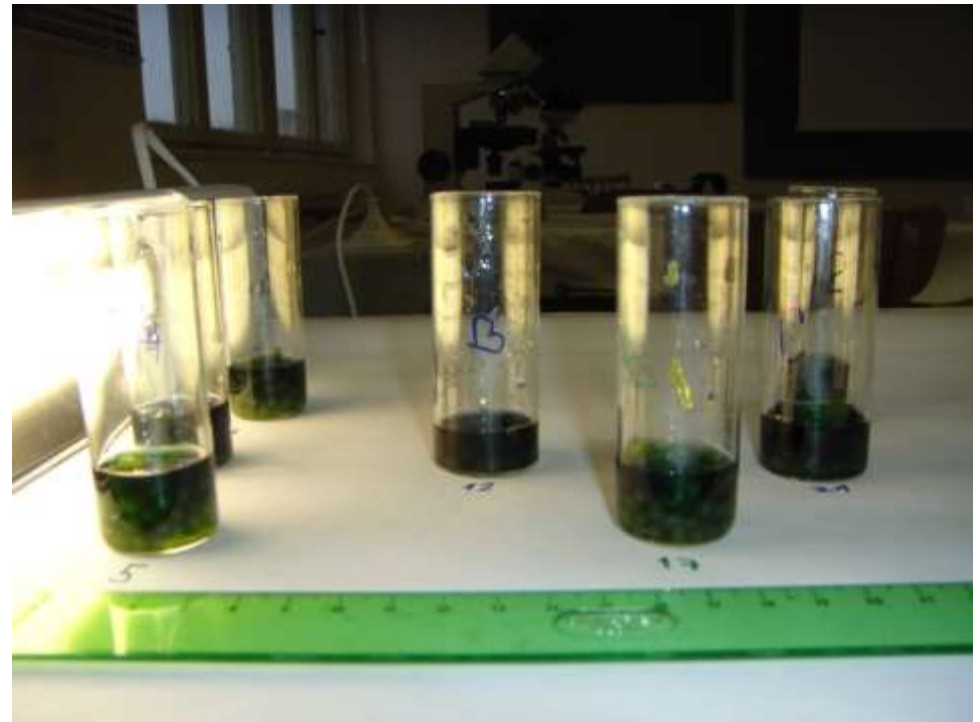
Students chose appropriate locations alone after discussion.

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

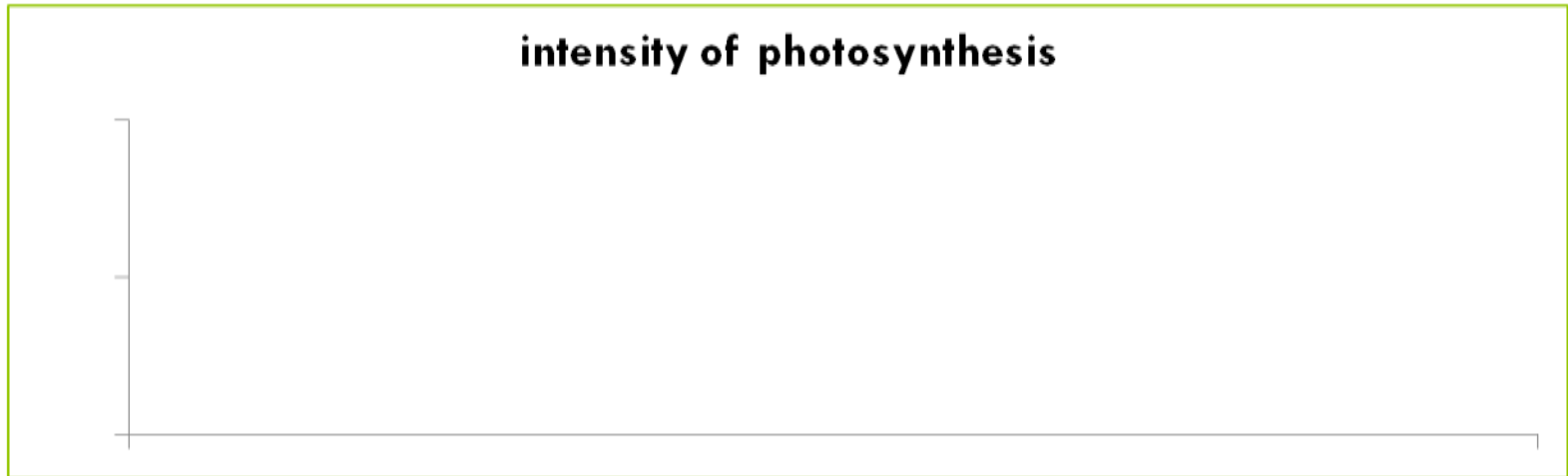
2. Location / layout/ of three samples

relationship of distances from light and photosynthesis

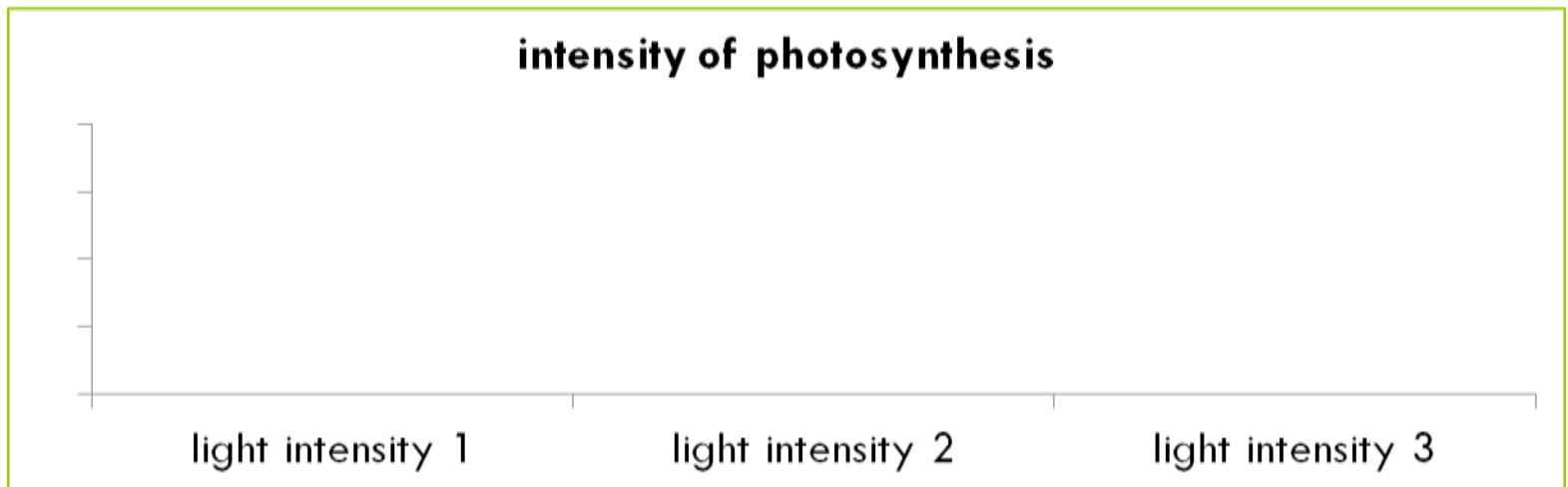
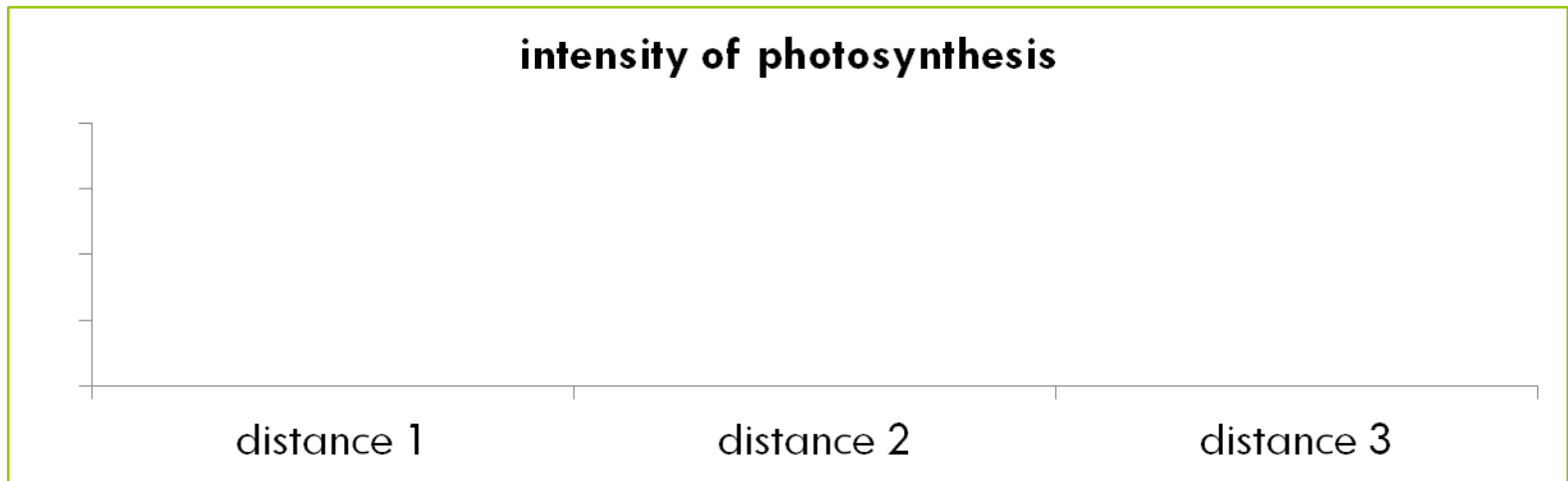
3. Data presentation

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 CO₂ concentration
- accurate explanation of the relationship between the intensity of photosynthesis and the colour change of the indicator

Students' output

LABORATORNÁ PRÁCA

potrebný pipeta, plastový pohár, kádica, silikón, lyžička, sekera, nádobky

postup: Z riasy sme pomocou pipety vyčítali guľôčky, ktoré sme nabalali do kádice s vodou. Silikom sme prešli voda. Nabalali sme došti guľôčky do vody. Každý lyžičkou sme šetrne vyčítali a mät, ktoré guľôčky "skochli" do 3 skúmaviek nádobky = každý mal rovnaký počet

výsledok: V každej 3 na skúmavkách nádobky bude 60 ml guľôček

záver dňa: Sme do skúmaviek nádobky vyčítali rovnaké množstvo guľôček. Každý mal rovnaký počet guľôček. Pomocou silikónu, ktorý sme použili na nádobku, sme dokázali, že guľôčky majú rovnakú hmotnosť. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček.

výsledok: Každá skúmavka mala rovnaké množstvo guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček.

záver: Každá skúmavka mala rovnaké množstvo guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček. Každý mal rovnaký počet guľôček.

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:

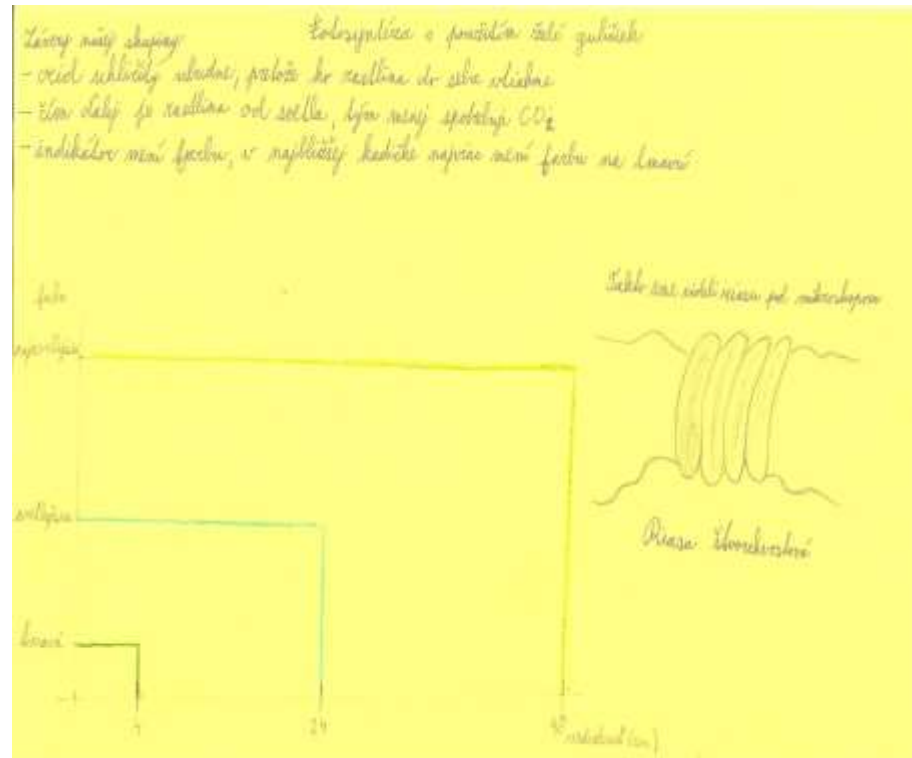
Hmotnosti materiálov:
 $m_1 = 21,7$ = hmotnosť každej skúmavky s tuhým alginátom vápenatým.
 $m_2 = 17,8$ = hmotnosť jednej skúmavky

Vzdialenosť skúmaviek pred viditeľným svetlom.

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

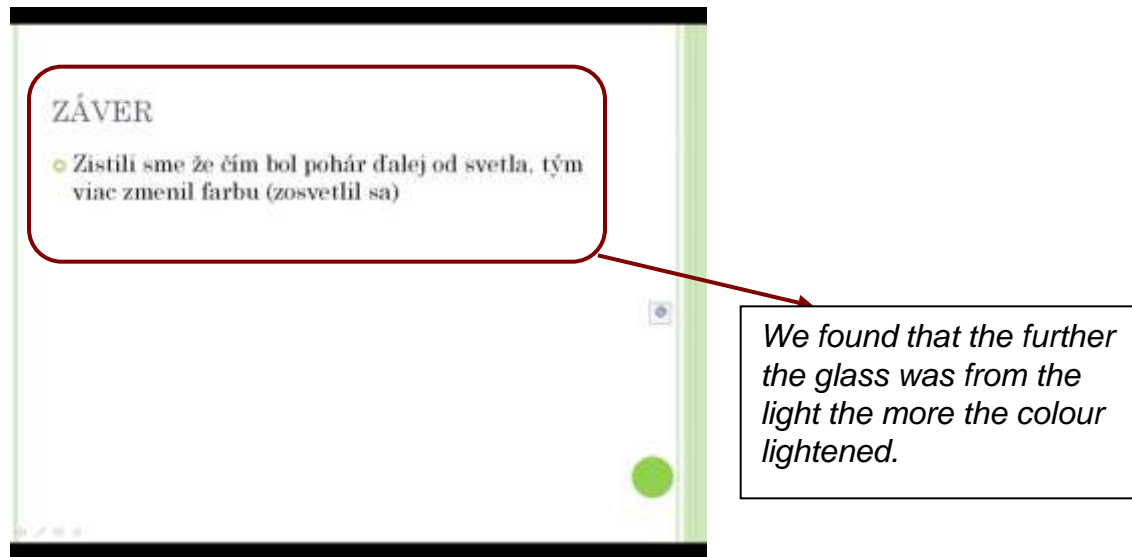
Objem CaCl₂ v každej skúmavke.
 =
 6 ml

Students' output



Students' graph

Conclusion of one of the groups



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

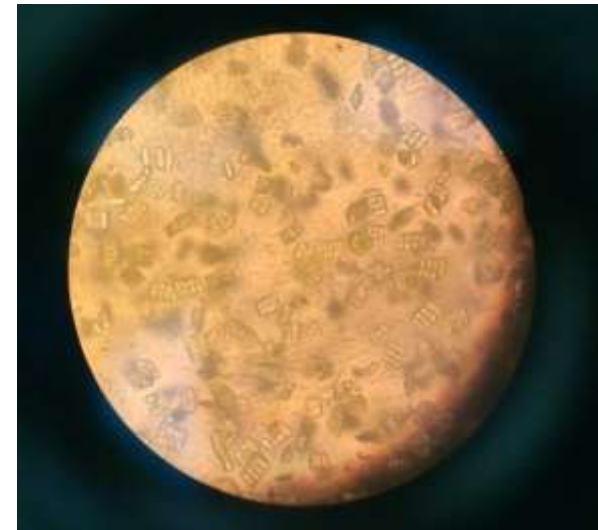
Conclusion

- 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

- 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