

ASSESSMENT OF SELECTED BIOLOGICAL ACTIVITY BASED ON INQUIRY AT LOWER SECONDARY

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INTRODUCTION

Whereas progress into science is based on experimenting it is important to develop practical skills. Opportunities for this are IBSE activities in the educational process of many science disciplines including biology. This study is aimed to determine the key moments suitable for assessment, and possibilities for formative assessment of inquiry based biology education – IBSE activity „Plant nutrition – photosynthesis of algae“, which develops several inquiry steps. In this activity pupils use algae to watch the rate of photosynthesis. First part of the practical involves ‘immobilising’ the algae making jelly algal balls. Then pupils use them to determine the rate of carbon dioxide absorption, which indicates how fast photosynthesis proceeds. The next step is very important to investigate the effect of light intensity on the rate of photosynthesis – pupils have to decide on the details of the quantities and how to vary the light intensity. There is no a key for teacher, how to assess forethought and realization of activity by pupils, cause there are not ‘marks for measuring’ their skills. The aim of this study was to make some aids for relative assessment of pupils' skills in inquiry.



METHODS

Pupils at the age of 12-13 and 15 years old observed colour changes of carbon dioxide indicator caused by carbon dioxide concentration change in the solution of immobilised algae as a result of effect of light intensity on the rate of photosynthesis. We assessed inquiry and reasoning skills. We have focused on key moments in which pupils could make the decision independently and proceeded in the experiment on the basis of their decision.

Assessment of selected three key – moments of inquiry planning:

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



Fig. 1.,2. Immobilization of algae



Fig. 3.,4. Distribution of algal balls



Fig. 5.,6. Carbon dioxide absorption using hydrogen-carbonate indicator and layout of samples

RESULTS AND DISCUSSION

Some pupils had strategy how to divide algal balls to three equal amounts so they didn't just tried it. In generally they endeavored to work precisely. When compared to younger pupils, older students write down dates clearer although didn't use option of entering data in the form of tables or graphs. Younger pupils often tried to draw the process or results. Students had very good technical skills and used available equipment for registration of experiment. They formulated a conclusion individually not the teams as may be the reason why they didn't express finding that depending on the light intensity varied carbon dioxide content, which caused coloration.

EDUCATIONAL IMPLICATIONS

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

Types of tasks in the worksheet

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

Proposal for a draft graph

- *Depending on pupils' age*

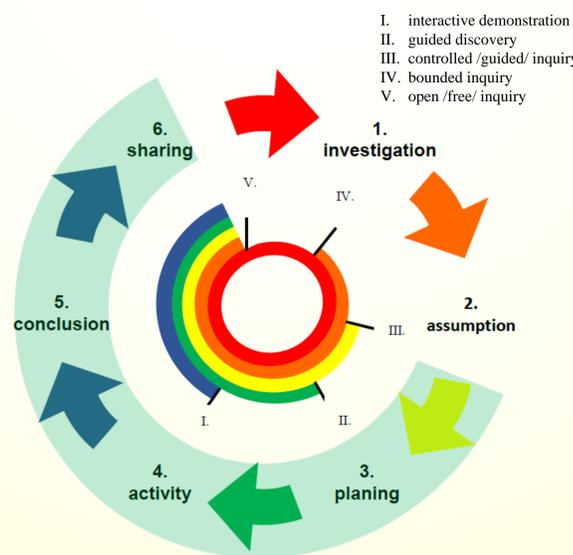


Fig.7. Active steps realized by the pupils (1st-6th) inquiry cycle IBSE at the level of inquiry I-V. (adjusted according, Wenning 2005)

Controlled inquiry – the third level of inquiry was applied in our activity. We assessed pupils' skills such as: participating in planning an experiment, activity on course of the experiment, ability to collect data making solid conclusion.

If students managed all three steps /plan, activity, conclusion/ we evaluated that they had all assumptions to share their results on good level with others.

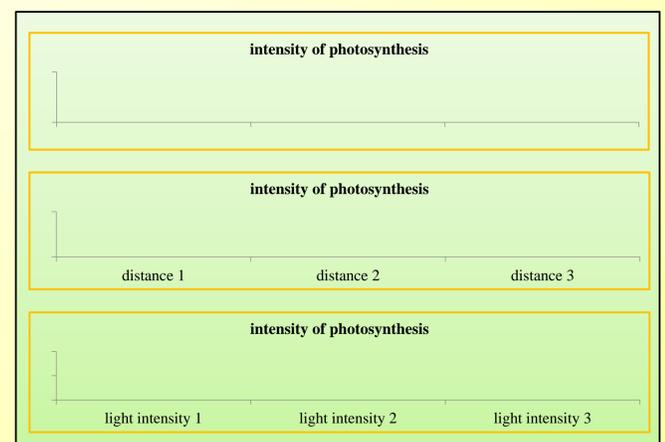


Fig. 8. Proposal for a draft graph

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 compare 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 marked	Able to reason the procedure in practical terms	Able to reason the procedure, builds on the fundamental of photosynthesis
3. Data entry	Data entered into a continuous text of process	Distinct process and results	Distinct process and results, accurate data entry	Enrolment of data about colour samples and their distance from the light pupil in itself proposed table

Tab. 1. Criteria for judging assessment data

REFERENCES

Wenning C.J., (2005), Levels of inquiry: Hierarchies of pedagogical practices and inquiry processes, *Journal of physics teacher education*, 2(3), 3-12