The methods of assessment

At the beginning of the inquiry activity the teacher, consulting with the students, devised the criteria of assessment. These were the following:

- planning and implementing the experiment
- formulating the research questions
- cooperation with group members

The main focus of assessment was the group’s work. When planning the test session a system of assessment criteria was developed to facilitate the formative assessment of the students’ work, which was given to the students. We assumed that with the help of the system of principles the students will be able to define the steps of their own progress.

The system of the principles of formative assessment

<table>
<thead>
<tr>
<th>Topics of assessment</th>
<th>Good</th>
<th>To be improved</th>
<th>Weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulating inquiry questions (oral expression)</td>
<td>Applies professional terminology appropriately and confidently</td>
<td>Usually knows the professional terminology, but does not always use it</td>
<td>Does not use the professional terminology</td>
</tr>
<tr>
<td>Planning and implementing the experiment</td>
<td>Able to carry out experiments alone and to record the results accurately</td>
<td>With some help the student is able to implement experiments and record results with minor improvements</td>
<td>Is not able to carry out the experiments on their own, nor to record the process and the results of the experiment</td>
</tr>
<tr>
<td>Formulating hypotheses</td>
<td>Is able to formulate their hypotheses and support it with arguments.</td>
<td>Is able to formulate their hypothesis and support it with some help.</td>
<td>Is not able to formulate the hypothesis, but is not able to support it with arguments.</td>
</tr>
<tr>
<td>Argumentation</td>
<td>Expresses their opinion logically. In case of a debate, the student defends his position with appropriate arguments.</td>
<td>Occasionally is not able to express their opinion logically. In case of a debate argues with difficulty.</td>
<td>Is not able to formulate their opinion, in case of a debate is not able to defend their opinion.</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Pays attention to peers, takes part in the work enthusiastically.</td>
<td>Pays attention to peers, finds their place in the work.</td>
<td>Cooperation</td>
</tr>
</tbody>
</table>

The decomposition of starch in saliva

Carbohydrates are the essential nutrients of the human body. These are the prime source of energy in our body. Their digestion begins in the oral cavity. Let’s examine the decomposition of starch in the saliva!

How can we prove that enzymes in the saliva begin digestion to simple sugars?

What factors affect the function of enzyme activity?

Plan an experiment to examine the different factors! The following tools are available:

- Required equipment:
  - 0.1% starch solution
  - 1% student solution
  - white ceramic
  - 3 pigeons
  - 2-3 glass sticks
  - distilled water
  - 2 beakers
  - 2 test tubes, a test tube holder
  - filter paper
  - measuring cylinder

During the planning don’t forget the different variables: the independent variable (what changes), the dependent variable (what you observe or measure) and the constant variable (what you choose to be constant during the observation).

After formulating the research questions:

- Consult with the teacher
- Prepare a plan for the implementation, plan the steps
- Perform the experiments and write down the observations.
- What environmental conditions are required for the enzyme to work efficiently?

The students worked in six groups. The groups recognized the variables and every group chose a variable the experiment based on which they designed.

The groups worked actively throughout the whole activity, they were motivated, as everyone examined the variables they were interested in.

They economized their time for themselves, this way they could repeat the experiments more often.

The result of the experiment

In the table we summarized the most important activities in class and the teacher’s guiding questions that helped hesitant students to move on. During the work half of the groups needed the teacher’s presence and reinforcement.

In the results column it can be seen that besides the specific subject skills, social competences [social cognition, orderliness, helping one another, leading] and self-regulative skills (self-management, self-control, cooperation with peers) also developed.

Results

Using on the first two rows of principles of formative assessment about half of the students were able to estimate their level correctly. Some underestimated their abilities; in these cases their peers supported them by boosting their self-confidence. As expected for the students’ age group, the opinions of their group members were important to them. Looking at the principles of argumentation and formulating hypotheses, the students had most difficulty formulating and managing the assessment. These fields of skills must be taken into account during future classes. For the row of principles of cooperation, the children estimated their own position well.

Conclusions

The groups needed reinforcement throughout the activity. The system of assessment principles helped them to assess their work. Special emphasis was placed on the discussion of opinions and personal impressions in the group’s self-assessment. The three-level scale is not detailed enough to evaluate the students’ work appropriately, but this simple system is the clearest for students of this age.

The system of assessment principles provided great help for the students with disabilities, it gave them a visual aid for identifying the fields they needed to focus on. Most of the students were motivated by the possibility of getting to the next level and they saw the differences between the levels.

Contact: nadasdzik@gmail.com

This project has received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement no 289085

- Zsuzsa Oláhné Nadasdi1, Géza Bartá2, Erzsébet Korom3
- 1 Politechnikum, Alternative Secondary School, Budapest
- 3 Institute of Education, University of Szeged

In a science class the 14-15 year-old students studied the structure and the functioning of the digestive system. The aim of the lesson is to get to know the process of the functioning of enzymes, to recognize and identify the factors affecting this process, to develop a hypothesis, design an experiment and test the hypothesis.

In heterogeneous groups of 4 the students tried to find the answer to the question of what factors affect the activity of the amylase enzyme. In the form of an unstructured activity they demonstrated that the digestion of starch begins in the oral cavity.

As there are a number of students with disabilities or with Hungarian as a second language in the class, we used a short technological guide during the activity.

Hungarian as a second language in the class, we used a short technological guide during the activity.

The aim was to test how our devised activity works; whether the students are able to design an experiment to study three variables (temperature, enzyme concentration and reaction time).

A further aim of the method was to test assessment methods that are suitable for the assessment of students at the group’s level.

The features of the session

In a science class the 14-15 year-old students studied the structure and the functioning of the digestive system. The aim of the lesson is to get to know the process of the functioning of enzymes, to recognize and identify the factors affecting this process, to develop a hypothesis, design an experiment and test the hypothesis.

In heterogeneous groups of 4 the students tried to find the answer to the question of what factors affect the activity of the amylase enzyme. In the form of an unstructured activity they demonstrated that the digestion of starch begins in the oral cavity.

As there are a number of students with disabilities or with Hungarian as a second language in the class, we used a short technology guide during the activity.

Hungarian as a second language in the class, we used a short technological guide during the activity.

The aim of the study

The aim was to test how our devised activity works; whether the students are able to design an experiment to study three variables (temperature, enzyme concentration and reaction time).

A further aim of the method was to test assessment methods that are suitable for the assessment of students at the group’s level.

Worksheet!

Studying the Decomposition of Starch in Saliva

Carbohydrates are the essential nutrients of the human body. These are the prime source of energy in our body. Their digestion begins in the oral cavity. Let’s examine the decomposition of starch in the saliva!

How can we prove that enzymes in the saliva begin digestion to simple sugars?

What factors affect the function of enzyme activity?

Plan an experiment to examine the different factors! The following tools are available:

- Required equipment:
  - 0.1% starch solution
  - 1% student solution
  - white ceramic
  - 3 pigeons
  - 2-3 glass sticks
  - distilled water
  - 2 beakers
  - 2 test tubes, a test tube holder
  - filter paper
  - measuring cylinder

During the planning don’t forget the different variables: the independent variable (what changes), the dependent variable (what you observe or measure) and the constant variable (what you choose to be constant during the observation).

After formulating the research questions:

- Consult with the teacher
- Prepare a plan for the implementation, plan the steps
- Perform the experiments and write down the observations.
- What environmental conditions are required for the enzyme to work efficiently?

The students worked in six groups. The groups recognized the variables and every group chose a variable the experiment based on which they designed.

The groups worked actively throughout the whole activity, they were motivated, as everyone examined the variables they were interested in.

They economized their time for themselves, this way the implementation of the experiments was possible even for students who worked slower.