Strategies for Assessment of Inquiry Learning in Science

TEACHING IDEAS SHARED FROM SAILS TEACHER EDUCATION PROGRAMME

Decomposition of starch in saliva

This resource has been developed through the SAILS Teacher Education Programmes (2012-2015) but was not developed as a finalized SAILS Inquiry and Assessment Unit. These materials are shared to inspire further use of inquiry and assessment of inquiry skills in the science classroom.

Strategies for Assessment of Inquiry Learning in Science

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Title: decomposition of starch in saliva

Level: 14-15 years of age
Course: science, biology
Time: 90 min.

1. Theme

The task is related to the subject of metabolism. The students have acquired knowledge of cell and body metabolism earlier. They are already familiar with healthy diet and the problems of unhealthy eating.
They know the most important nutrients. They understand the properties of materials and energy. All of them understand laboratory procedures, the basic handling of the most common chemicals and compounds.

2. Contents

All throughout, we will use elements of inquiry based learning:

Prior knowledge of students
Inquiry guided by the students
Consideration of alternative methods and approach
Questions to support independent learning
Solving of unstructured problems
Group work

Depending on the skills of the students and their prior knowledge the task can be unstructured or half structured.

3. expected readiness and skills

- Presuppositions
- Planning experiments
- Measurement
- Recognizance of connections
- Recognizance of variables
- Observation of experimental processes
- Communicating observations
- Cooperation in a group
- Utilization of scientific knowledge in everyday life

4. Learning goals (expected results)

- The deepening of knowledge of the gastrointestinal system, through experimentation
- The understanding of enzyme functions
- Processes that modify enzyme function

    - Observing the effects of amylase enzyme
    - Knowledge about the chemical properties of nutrients
    - Finding foods that contain starch
- The development of oral expression
- The development of casual thinking
- The ability to plan and construct experiments

5. Learning activity

Defying the problem:

Carbohydrates are the essential nutrients of the human body. These are the prime source of energy in our body. If we do not get sufficient energy, we become tired, headache kicks in and we begin to long for sugary foods: chocolate cookies, donuts, sugary soft drinks appear in our minds. However it matters what sort of carbohydrates we provide our body with. Starch contained in bread, potato or rice provides more than half of our calorie requirement.
Their digestion begins in the oral cavity. How could one prove that enzymes in the saliva begin digestion to simple sugars? Does temperature affect the enzyme's function?
Unstructured task

Recommended activity during the lesson

Attunement:
Talking about the student's eating habits: favorite foods, drinks
Changes in nutritional habits: (canteen, fast food)
Nutritional pyramid
Starch containing foods
Assessment of prior knowledge:
The role of nutrients taken up by the body
Cellular metabolism
Chemical composition of cells
Plant structures that contain starch
Detection of starch
Work form:
Group work

Teacher's instructions:
In groups of 3-4, design and carry out an experiment to detect enzyme activity and to determine amylase function.

Equipment available for the experiment:

Required equipment: accessories for water bath, pipettes, white ceramic, test tubes, test tube holder
Required materials: starch solution, Lugol's-solution, purified water, saliva

Teacher's instructions:

After formulating the inquiry questions, consult with the teacher!
Plan the step by step procedures!
Perform the experiments and write down the observations!

Teacher support:

Formulation of interpretative questions (constant, variable)

Performing the task:

1. Selection of materials and equipment
2. Planning of the process and designing of the experiment
3. Taking account of the variables

Helpful questions:

What materials can be detected with the Lugol's-solution?
What is the structural explanation of the color change?
What does starch decay into due to the amylase in saliva?
What environmental conditions are required for the enzyme to work efficiently?

Mathematical skills:

How could the color change be depicted on a graph in correlation to time?
What instruments are suitable for measurment?

Experiments:

The demonstration of enzyme function through the action of amylase on starch
The effect of temperature on the process

Recording of steps:

Writing of protocol
Table chart

Partially Structured Task

In case the students fail to continue the task, the following instructions are recommended:

Teacher support for carrying out the experiment

How can it be determined that the decay of starch has begun in the saliva?
How does temperature affect enzyme functions?
How fast is the starch decay process?
What factors determine enzyme activity?

Teacher's support for interpretation

Constants and variables: Identify the various variables during the experiment: independent variable (that changes), dependent variable (that is observed) and the constant variable (that can be taken as constant during the experiment)

How can you detect amylase in saliva?
What material can be detected with Lugol's-solution?
What is the structural explanation for color change?
What does starch decay into due to amylase?
What factors determine enzyme activity?

Supportive questions to aid the experiment.

Steps of the experiment

<u>Preparation of saliva solution:</u>

1) Put 1dl of purified water into a plastic cup!
2) Wash mouth with 0,5dl of water and spit it into the cup!
3) Repeat the process!

<u>Detecting amylase</u>

1. Put 1ml of saliva solution into a test tube!
2. Add 2ml 0,1% starch solution to the test tube!
3. Put the test tube into a 37 Celsius temperature bath!
4. Take samples every 5 minutes and put a drop from it on the white ceramic plate! Add a drop of Lugol's solution!
5. Repeat the above mentioned until change appears

Helpful questions:

What do you observe when adding the Lugol's solution?
What difference appears compared to the first sample at the end?

Experimental steps:

How does temperature affect the decay of starch?
Carry out the experiment with:

1. Place the test tube into icy water
2. Place the test tube into boiling water

What difference do you observe?

Recording of the steps taken: table chart

The decomposition of starch with amylase

Experiment **Change**	Starch solution + saliva	Starch solution+ purified water
10 min		
15 min		
20 min		
25 min		

How does the temperature affect the experiment?

Time	icy water	boiling water
10 min		
15 min		
20 min		
25 min		

6: Evaluation:

Support for the formative evaluation
Before the task:

- Laying down the evaluation principals
  - Understanding the task
  - Formulating inquiry questions
  - Setting up the experiment
- Assessing prior knowledge

During the experiment:

- Observing the activity: How do the students work in group?
- Observing the planning: Setting up the experiment, formulating inquiry questions
- Manual work: Experimental process

After the task:

- Feedback, evaluating the work done
- scientific knowledge
  - Understanding enzyme function
  - Understanding the conditions of enzyme function
  - Starch content of foods
- developing casual thinking
- developing oral expression
- carrying out an experiment
- assembling a work portfolio (protocol, pictures, video)

Aspects of formative evaluation

aspects	skills
Oral expression	- You use the terminology accurately and confidently. - You know the terminology, but sometimes fail to use it. - You do not know the terminology. - You can communicate in accordance to the situation. - You do not communicate in accordance to the situation.
Designing and implementing an experiment	- You can carry out the experiment, you make accurate observations, you understand the connections and you record your observations in writing or depiction. - With help, You can carry out the experiment, you make accurate observations, you understand the connections and you record your observations in writing or depiction. - You are unable to carry out the experiment, make accurate observations, you don't understand the connections and you don't record your observations in writing or depiction.
Casual thinking	- You are able to identify and recall connections. - With little help, you are able to identify and recall connections - You are only able to identify connections with help and support
Logical thinking	- You are able to follow an occurrence and can understand the reasons behind it, you use induction and deduction. - With help, You are able to follow an occurrence and can understand the reasons behind it, you use induction and deduction. - With help, You are able to follow an occurrence and can understand the reasons behind it, you don't use induction or deduction.

7. Taking the task further:

It becomes possible to utilize the skills and knowledge gathered by the students in later instances:

- Blind test: How does the process work without the presupposed material
- How many experiments are needed for all the process variations?
- How does pH change affect enzyme activity?
- The skill acquired during the experiment can be utilized in other experiments.

Inductive thinking, finding similarities.