

## Workshop 6

# Inquiry based learning in practice

# What is Inquiry Activities?

# What is Inquiry-based Learning?

Inquiry-Based learning is student-directed and can be linked to John Dewey's philosophy that education begins with the curiosity of the learner. <http://www.inquiry-based.com/index.html>

"It is an approach to learning whereby students find and use a variety of sources of information and ideas to increase their understanding of a problem, topic, or issue....it espouses investigation, exploration, research, pursuit, and study."

Guided Inquiry Learning in the 21st Century, Kuhlthau, Maniotes, Caspari, Libraries Unlimited, 2007

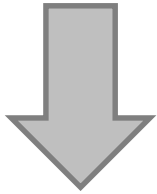
# INQUIRY Approach versus COVERAGE Approach

INQUIRY	COVERAGE
⇒ Student voice and choice	⇒ Teacher selection and direction
⇒ Questions and concepts	⇒ Assigned topics and isolated facts
⇒ Collaborative work	⇒ Solitary work
⇒ Strategic thinking	⇒ Memorization
⇒ Authentic investigations	⇒ As if/surrogate learning
⇒ Student responsibility	⇒ Student compliance
⇒ Student as knowledge creator	⇒ Student as information receiver
⇒ Interaction and talk	⇒ Quiet and listening
⇒ Teacher as model and coach	⇒ Teacher as expert and presenter
⇒ Multiple resources	⇒ Reliance on a textbook
⇒ Cross-disciplinary studies	⇒ One subject at a time

Comprehension and Collaboration 2009

by Stephanie Harvey and Harvey Daniels, (Heinemann, Portsmouth, NH)

## In Science Subject



## Inquiry Based Science Education

Inquiry based approaches to science education focus on student constructed learning as opposed to teacher-transmitted information.

# Inquiry Based in Science Education

Allows students to...

- ⇒ Develop skills of organization and interpretation of scientific data;
- ⇒ Provide explanations and make predictions based on the evidence;
- ⇒ Work collaboratively, communicate your ideas and respect others ideas;
- ⇒ Express in an adequate scientific language, in written and oral form;
- ⇒ Apply learning to real contexts;
- ⇒ Reflect critically on the strategies used and the results obtained;

Harlen & Allende (2006). IAP Report of the Working Group on the International Collaboration in the Evaluation of IBSE programs

## Types of Inquiry Activities

Investitions of the type: “Which”	<ul style="list-style-type: none"> <li>⇒ Which of the factors affects ...?</li> <li>⇒ Which is the best plan...?</li> </ul>
Investitions of the type: “What”	<ul style="list-style-type: none"> <li>⇒ What happens if ...?</li> <li>⇒ What is the relationship between ... ?</li> </ul>
Investitions of the type: “How”	<ul style="list-style-type: none"> <li>⇒ How does X fail with Y ...?</li> <li>⇒ How does X affects Y ...?</li> </ul>
General Investigations	<ul style="list-style-type: none"> <li>⇒ A long term project</li> <li>⇒ A historical or local quizz</li> </ul>
Problem solving activities	<ul style="list-style-type: none"> <li>⇒ Simulations</li> <li>⇒ Solve a practical problem</li> </ul>

Wellington (2000)

## Skills for the 21st century

### ❖ Critical thinking and problem solving

⇒ Ability to make decisions, solve problems and act appropriately

### ❖ Effective communication

⇒ Ability to synthesize and transmit ideas, both in written and oral form

### ❖ Collaboration

⇒ Ability to work with others, often coming from different groups and with opposing ideas

### ❖ Creativity and innovation

⇒ Ability to see what isn't visible and to make things happen

AMA (2010). Critical Skills Survey

## Skills for the 21st century

### ❖ Ways of thinking

- ⇒ Creativity and innovation
- ⇒ Critical thinking, problem solving and decision making
- ⇒ Learning to learn, metacognition

### ❖ Ways of working

- ⇒ Communication
- ⇒ ⇒ Collaboration (teamwork)

### ❖ Working tools

- ⇒ Literacy in new technologies

### ❖ Living in the world

- ⇒ Citizenship (local and global)
- ⇒ Life and career
- ⇒ Personal and social responsibility (including care and competence)

Griffin, McGaw & Care, (2012). Assessing and teaching for 21st century skills

## Theoric model



Bybee, 1997

# Inquiry model

## ENGAGE

Os alunos são motivados, suscitando a sua curiosidade e interesse relativamente a uma situação problemática. Explorar

## EXPLORE

Students ask questions, make predictions, formulate hypotheses, plan experiments, perform observations, record observations, discuss results, and redefine hypotheses if necessary.

## EXPLAIN

The students present their conclusions, basing their position and argumentation on the results obtained in the previous phase.

## EXTEND

Additional problems are presented to the students, so that they generalize the conceptual knowledge acquired to other contexts, raising questions that lead to new investigations.

## EVALUATE

Students reflect on the work they have done, which allows them to see what they can do better and where they have had more difficulties.

## **What defines an activity as being Inquiry Based Science Education**

It begins with a problem identified in a given scenario;

Students have to construct a way to respond to the problem formulated, using various sources of information, separating main information from ancillary;

It implies some investigation (more or less oriented, depending on the activity and the age of the students);

Depending on the activity, is involved experimental work, roleplaying and / or decision making;

It often involves interdisciplinary approaches;

The teacher assumes a role of orientation and challenge, ensuring that the problem is solved;

It involves evaluation associated to the different phases, using for this different instruments that include criteria and levels of performance.

# **SAILS – Strategies for Assessment of Inquiry Learning in Science (IBSE)**

The SAILS project has demonstrated how inquiry approaches can be used for teaching a range of scientific topics, and has helped science teachers become confident and competent in the assessment of their students' learning through inquiry..

## Inquiry Skills and Competencies

Within the SAILS project, inquiry in the science classroom is understood to be the intentional process of providing opportunities where students are actively involved in diagnosing problems, critiquing experiments and distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers, and forming coherent arguments.

In carrying out this project, SAILS has focussed on supporting the development of four inquiry skills (developing hypotheses, working collaboratively, forming coherent arguments, planning investigations) as well as the competencies of scientific reasoning and scientific literacy.

## Assessment Practices

In classrooms, the role of assessment is to support and encourage student learning. Assessment within the inquiry classroom offers richer possibilities, both in terms of inquiry skills and competencies as well as methods to assess. Inquiry learning is an active and constructivist process thus assessment feedback should be integrated into this. Assessment of IBSE skills and competencies requires teachers to be able to use a variety of tools to determine where students are in their learning. From these data, they can make judgements that can help the student to decide on the next step in learning, and so guide them towards improvement. The SAILS Framework for Inquiry and Assessment considers the assessment and feedback in terms of what is assessed, when is it assessed and by whom is the assessment carried out.

# How to evaluate an inquiry activity?

Inquiry skills and processes	Emerging	Developing	Consolidating	Extending
<p><b>Working collaboratively</b>                      Interpersonal relationships and group functioning</p>	<p>Observes and accepts the colleagues' proposals in the organisation of the group work, but gives no suggestions; merely accepts what the colleagues are doing.</p>	<p>Participates in the organisation of the group work, but only makes one or two suggestions that add little value to what was already done</p>	<p>Participates in the organisation of the group work and gives positive suggestions contributing to a productive group dynamic.</p>	<p>Participates in the organisation of the group work and significantly contributes to a productive group dynamic, creating positive personal interactions</p>
<p><b>Developing hypotheses</b></p>	<p>Formulates hypotheses that are not consistent with the planning or that are not eligible for investigation</p>	<p>Formulates hypotheses that are consistent with the planning of the experiment.</p>	<p>Formulates hypotheses that are consistent with the planned experiment and are based on the research questions.</p>	<p>Formulates hypotheses that are consistent with the planned experiment. Those hypotheses are based on the research questions and identified variables.</p>



<https://www.youtube.com/watch?v=sLQPXd8BiIA>