

ASSESSMENT



LEARNING

Assessment - OF, FOR, AS - LEARNING in Science

Martin Musumeci

Department of Mathematics and Science Education
Faculty of Education

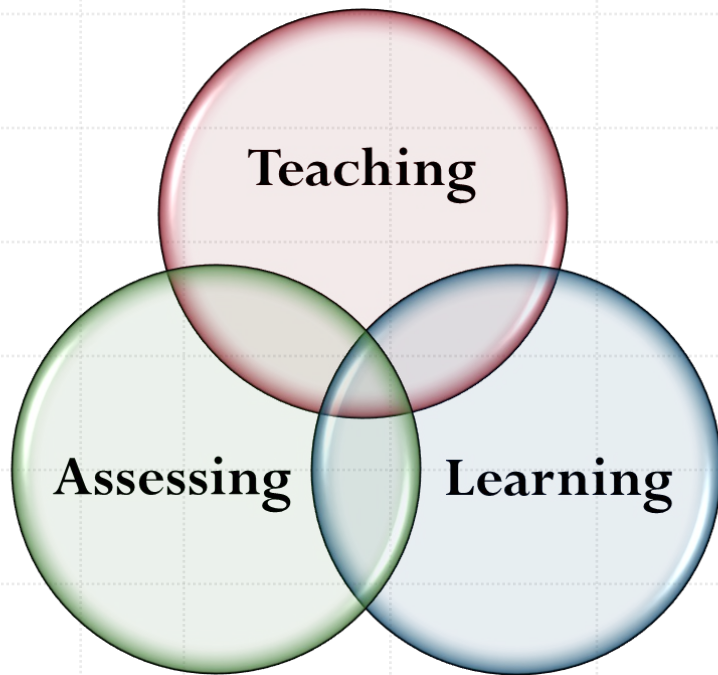
University of Malta



Thursday 14th March 2024



Teaching, LEARNING and Assessing



Teaching, **LEARNING**, and assessing are **three interrelated components** of education that **work together** to **facilitate effective knowledge acquisition and skill development**.

Each component influences and is influenced by the others – **a dynamic process** aimed at achieving educational objectives.

Teaching

- ✓ Teaching involves the **deliberate transmission of knowledge, skills, and values** from educator to learner.
- ✓ Effective **teaching methods** include: lectures, demonstrations, discussions, hands-on activities, multimedia presentations, etc.
- ✓ Teachers design **learning experiences**, select **instructional materials**, and create **a supportive learning environment**.
- ✓ Effective **teaching methods** directly impact the learning outcomes of students.

Teaching, **LEARNING** and Assessing

Learning

- ✓ Learning is the process by which individuals **acquire new knowledge, skills, attitudes, and values.**
- ✓ It involves **active engagement, assimilation of information, and the construction of meaning** by the learner.
- ✓ Learning can occur through **various modalities**, including: listening, observing, practicing, reflecting, interacting with others, etc.
- ✓ Learners bring their **prior knowledge, experiences, and motivations** to the learning process, shaping how they engage with new content.
- ✓ Effective learning is facilitated by clear objectives, relevant content, meaningful experiences, and opportunities for practice and **feedback.**

Teaching, **LEARNING** and Assessing

Assessing

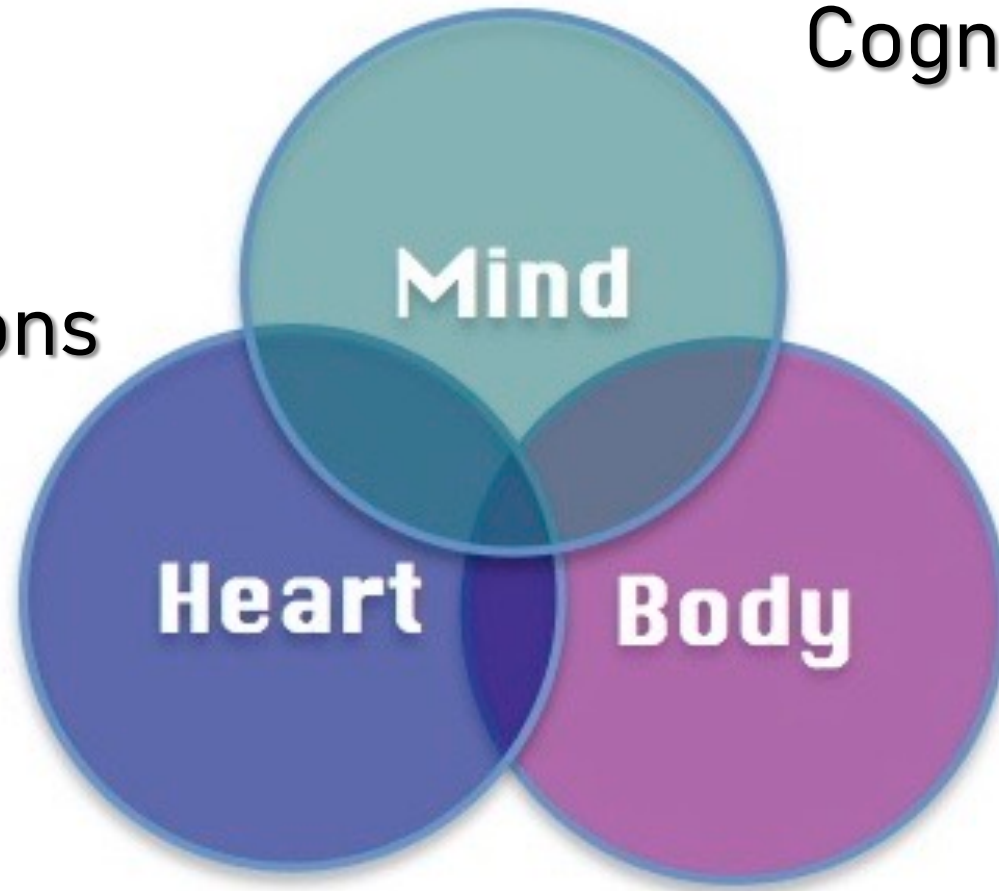
- ✓ Assessment involves the systematic **gathering and interpretation of evidence** to **evaluate learning outcomes and progress**.
- ✓ It serves multiple purposes, including: measuring achievement, diagnosing learning needs, guiding the teaching, and providing **feedback** to learners.
- ✓ Assessment methods include: tests, quizzes, projects, presentations, observations, portfolios, self-assessments, etc.
- ✓ Assessment **informs teaching practices** by identifying areas of strength and weakness in student understanding and guiding educational adjustments.
- ✓ It plays a crucial role in **motivating students**, providing **recognition for their achievements**, and **promoting continuous improvement**.

Teaching, **LEARNING** and Assessing

- ✓ Effective teaching practices facilitate **active engagement and meaningful learning experiences**, which in turn **enhance the assessment process**.
- ✓ Assessment results provide **feedback** to **both teachers and students**, informing educational decisions and guiding further learning activities.
- ✓ **Continuous feedback loops** between teaching, learning, and assessing promote **iterative improvement** in educational practices and student outcomes.
- ✓ **Teaching, learning, and assessing are interconnected processes that collaboratively contribute to the achievement of educational goals. Effective integration of these components fosters an environment conducive to meaningful learning and ongoing development.**

LEARNING DOMAINS . . . the three Hs

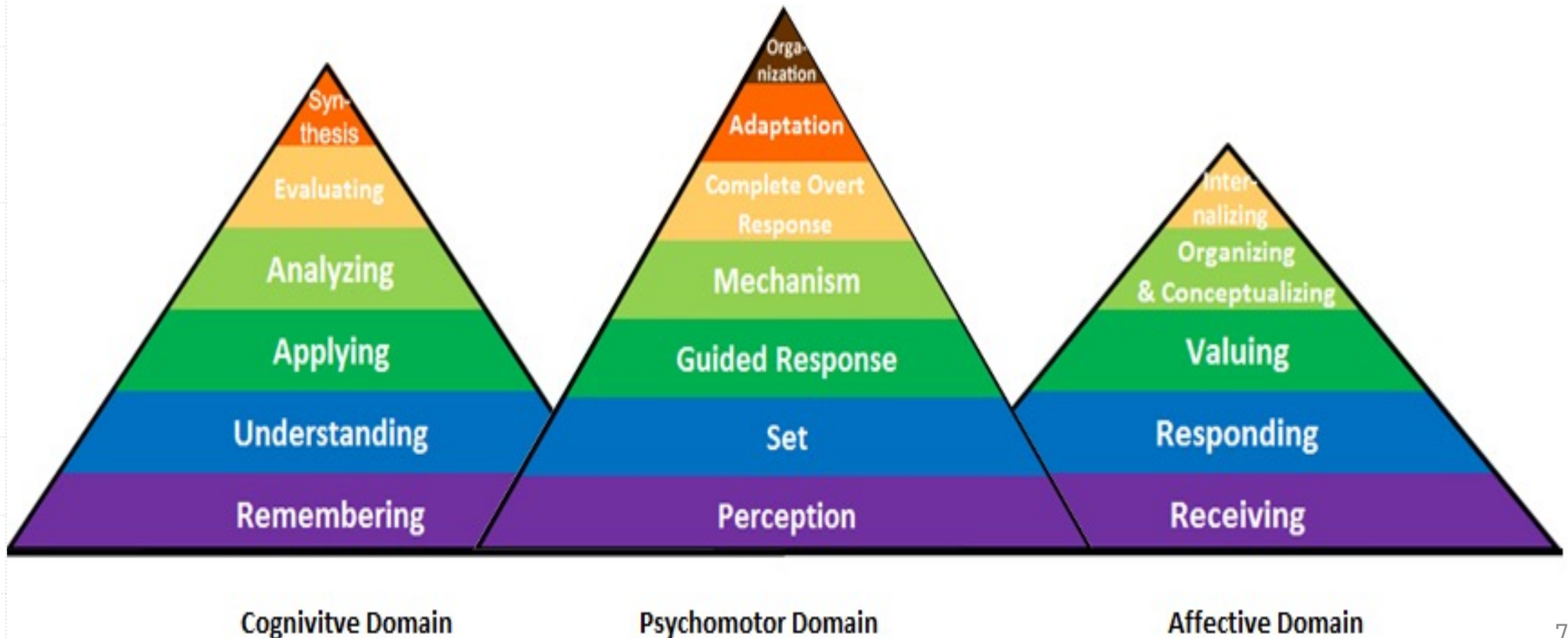
Affective reactions
[Heart]



Cognitive processes
[Head]

Psychomotor skills
[Hands]

The Categories of OBJECTIVES in the LEARNING domains





In the classroom . . . Formal learning

- ✓ Content knowledge
- ✓ Students' conceptions
- ✓ Prior knowledge

The Principles of LEARNING

1. The first principle of learning: to **start from where the learner is**.

Students have to **actively reconstruct their ideas** – it is not merely adding an overlay, a further layer, of new ideas that leads to poor understanding, if not confusion.

Moreover, one should encourage and listen carefully to **a range of responses**, whether right or wrong – helping students to talk through inconsistencies and to respond to challenges. Teachers should **meet their learning needs**.

2. The second principle of learning: students must be **active in the process**.

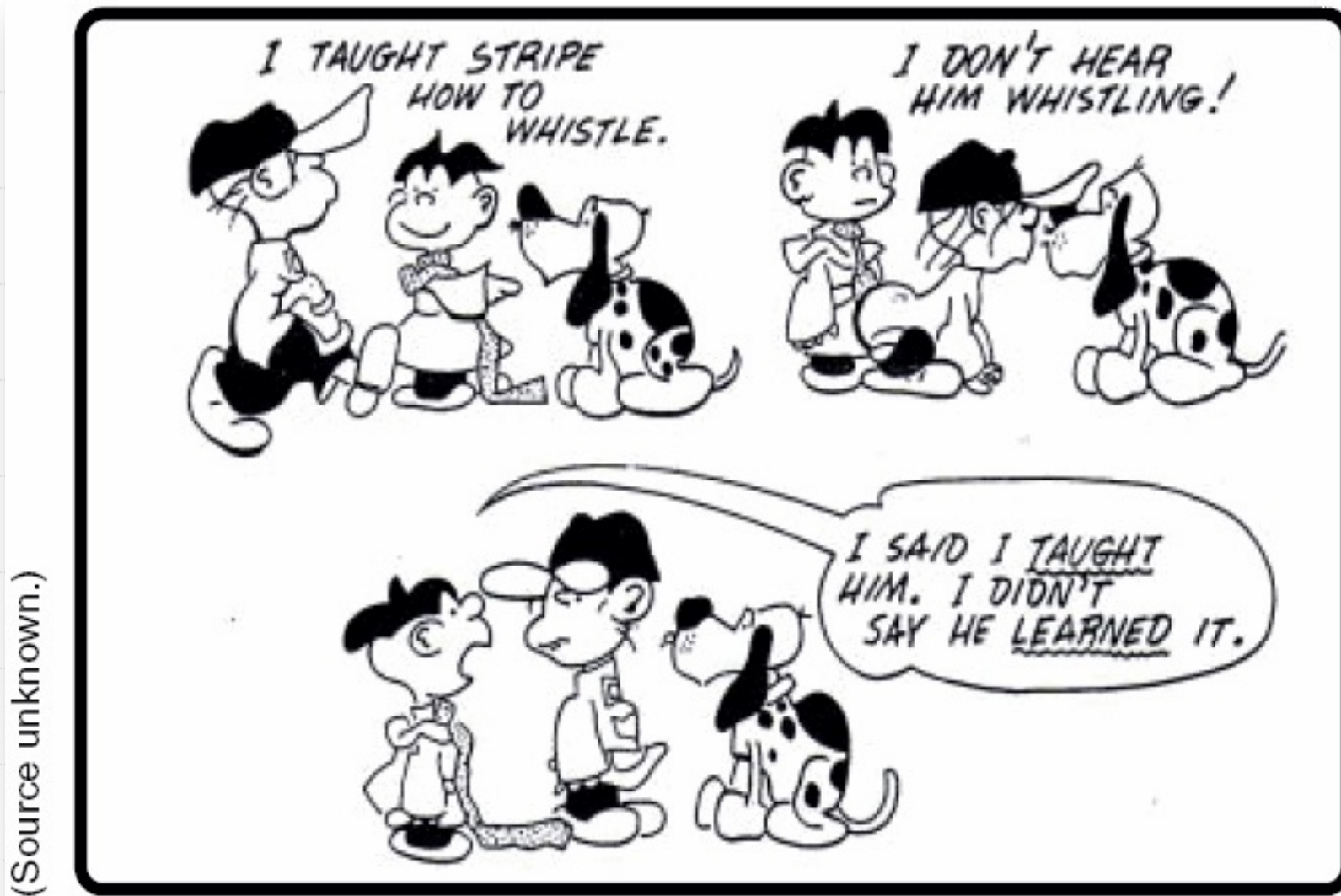
Learning has to be **done by them**, it **cannot be done for them**.

3. The third principle of learning: students need **to understand the learning target, what counts as work of good quality**, and **know where they stand with respect to the target** => They need to achieve **meta-cognition** = the power to **oversee and steer their own learning** in the right direction and **be responsible** for it.

Peer- and self-assessment are essential here – They promote **active involvement**, practice in **making judgements** about the quality of work (their own and of fellow students).

4. The fourth principle of learning: **'TALKING THE TALK'** – when students are talking about science, they are using the language of science.

How do we get **FEEDBACK** about **LEARNING** ?



FEEDBACK

Feedback is important for the **motivation** and **self-esteem** of students . . .

There are two kinds of feedback:

- (1) The first type focuses on **the student as a good or bad achiever** – judgement by marks, grades, rank-order lists, etc. It develops ego-involvement, may have negative effects, discourages low-attainers, makes high-attainers avoid tasks if they do not see ‘success’.
- (2) The second type does **NOT** focus on **the person**, but **on the strength and weaknesses of the given piece of work** – what needs to be done to improve, what helps to develop task-involvement. It has positive effects, it can encourage all students to see that they can do better by trying, that they can learn from mistakes and failures.

ASSESSMENT



LEARNING

Assessment **OF** learning

... is used:

- **To find out** what pupils know, understand and can do – which may then be used for formal certification.
- **To report** progress to parents, and to judge teacher and school effectiveness.

Assessment **FOR** learning

... is used:

- **To find out** what pupils know, understand and can do – ~~which may then be used for formal certification.~~ ... *BUT* it **includes the pupil** in the process.
- **Enables the teacher** to plan how **to help the pupils make progress and develop** their understanding and skills.

Assessment FOR learning . . . FEEDBACK

Assessment for learning is any assessment for which the **first priority** is **to promote pupils' learning**.

It provides **information** to be used as **FEEDBACK** – by teachers and pupils – in **assessing themselves and each other**, to **modify the teaching and learning activities**.

It becomes **FORMATIVE ASSESSMENT** when the evidence is used **to adapt the teaching to meet learning needs**.

Teachers are pressured to improve their work, raise their standards, improve students' test scores and grades, etc. – such pressures amount to little more than *'must try harder'*.

POSSIBLE PROBLEM: Telling teachers how they should do their job better can be offensive – if it comes from those who do not share their everyday problems.

Assessment FOR learning . . .

Questioning dialogue and **FEEDBACK**

Effective feedback needs to arise **from learning experiences** that provide rich evidence so that **judgements about the next step in learning** can be made.

There are a number of ways. The essential ingredients are:

Challenging activities that promote thinking and discussion

Rich questions

Strategies to support learners in revealing their ideas

Opportunity for peer discussion about ideas

Group and whole-class discussions which encourage open dialogue

Assessment FOR learning

We should thrive **to interact more effectively with students**, on a day-to-day basis, and **promote their learning**.

The specific intent is the improvement of (science) education.

The recommendations are grounded in the findings of many decades of research into **effective learning** and the factors that **enhance the motivation and self-esteem of learners**.

The content of (science) lessons is determined by the national Curriculum schemes, exam syllabi, . . .

[Science provides] the means by which learners can **interact with the world around them** and **develop ideas** about the phenomena they experience . . . equip them with **ways to observe and question** what is happening . . . equip them with ways **to observe and question what is happening** . . . work out and **predict** what might happen if conditions change.

Assessment FOR learning

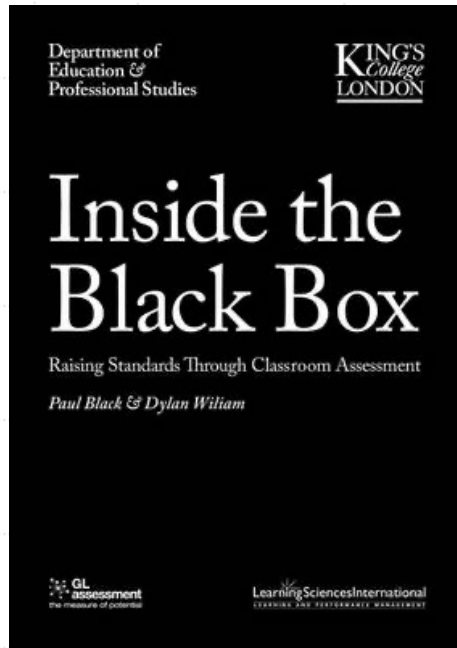
To be able to learn (science) in this way, students need help in **developing process**, skills to **investigate**, and **communication skills** to **question and discuss findings**.

Formative assessment fits well into this learning scenario.

Let's not forget that . . . At given times, learners also have to prepare for examinations. There has to be time set aside near the end of courses for 'examination techniques'.

Feedback, peer- and self-assessment all have important roles in this process – if utilised properly, formative assessment can result in large learning gains.

The potential of ICT: There are many good resources available, that allow time to focus on the thinking, provide diagnostic assessment that supports learning and teachers in deciding the next steps in learning.



History . . . RESEARCH

- Black, P., and Wiliam, D. (1998) Assessment and Classroom Learning. *Assessment in Education: Principles, Policy and Practice*, 5(1), 7-73. Raising Standards Through Classroom Assessment
- Black, P., and Wiliam, D. (1998) *Inside the Black Box*. nferNelson, London.
- Black, P., and Harrison, C. (2004) *Science Inside the Black Box*. GL Assessment, London. Assessment for Learning in the Science Classroom

- ✓ **Evidence that formative assessment can raise standards of pupil achievement.**
- ✓ **Almost all teachers were positive about the effects of the project.**
- ✓ **There were significant gains in test performance.**

- Black, P. et al. (2002) Working inside the black box: assessment for learning in the classroom. nferNelson, London.
- Black, P. et al. (2003) Assessment for Learning: putting it into practice. Open University Press, London.



Assessment **AS** learning

- It **enables the teacher and the student** to **evaluate** the **students' understanding** of content knowledge through the feedback obtained.
- The teachers and the students themselves **monitor the learning**, ask questions and use a range of strategies to decide what they know and can do, and how **to use assessment information for new learning**.

Let's reflect . . .

Let's think about **the type/s of assessment** we use/have used in class.

- When do/did we use assessment for learning in our classroom?
- Is this type of assessment a good type of assessment for . . . ?

The answer to the last question lies in considering . . . Pedagogy

Pedagogy is commonly referred to **the art and science of teaching**.

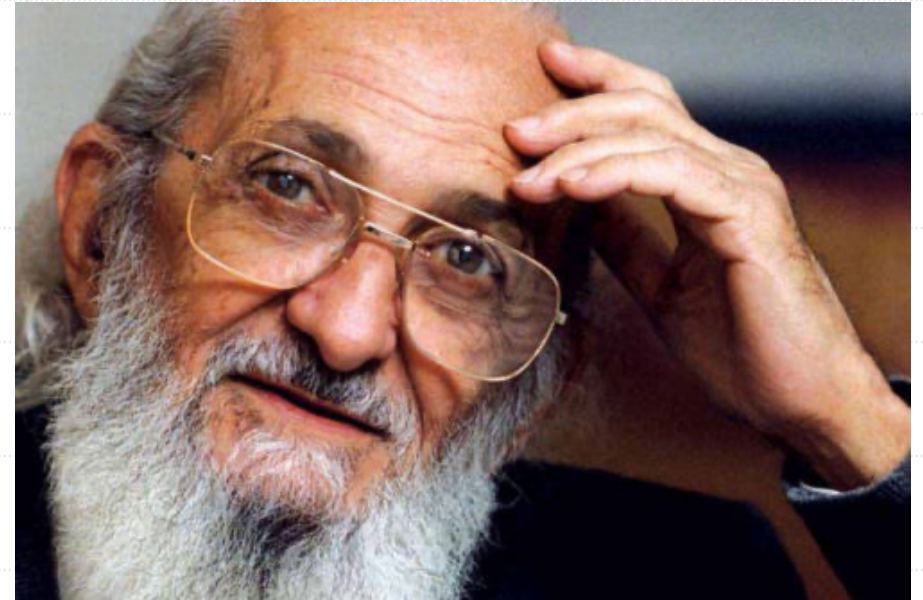
Taken as an academic discipline, it is the study of **how knowledge and skills are exchanged in an educational context**.

It also considers **the interactions that take place during learning**.

Paulo Freire [1921-1997]

Pedagogy considers . . .

Habits of thought, reading, writing, and speaking which go beneath surface meaning, first impressions, dominant myths, official pronouncements, traditional clichés, received wisdom, and mere opinions, to understand the deep meaning, root causes, social context, ideology, and personal consequences of any action, event, object, process, organization, experience, text, subject matter, policy, mass media, or discourse.



Thus the educational activity involves . . .

- Communication
- Creative thinking
- Enquiry
- Evaluation
- Information processing
- Critical thinking
- Problem-solving
- Reasoning . . .

One should ask:

Which of the above aspects are included in my 'activity' ?

What was the starting point of the design of my 'activity' ?

Example: Students' conceptions of the environment

A research project – 2249 young people, ages 9 to 17, New South Wales, Australia.
Responses given to the statement 'I think the term/word environment means ...' were analysed using a qualitative research method.
(Loughland et al., 2003)

Six distinct conceptions were inferred from the children's feedback.

OBJECT Focus Conception

1. The environment is a place.
2. The environment is a place that contains living things.
3. The environment is a place that contains living things and people.

RELATIONAL Focus Conception

1. The environment does something for people.
2. People are part of the environment and are responsible for it.
3. People and the environment are in a mutually sustaining relationship.

Example: Students' conceptions of the environment

least inclusive

environment as a place

(Loughland et al, 2003)

most inclusive

people in a relationship of
mutual sustainability

Other researchers suggested that environmental orientations could be placed on a continuum ranging from . . .

nature as object

(Killingsworth & Palmer, 1992)

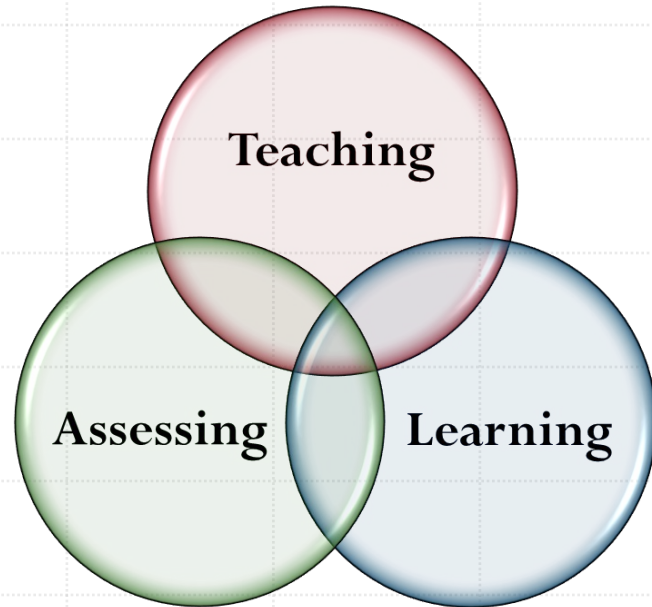
nature as spirit

egoistic

(Stem et al., 1993)

biospheric

Reflect and discuss . . .



Assess your activity . . . It will help you to identify:

[i] How well did the students understand the content presented?

and

[ii] Was the students' focus conception on the environment object or relational?

Giving feedback to participants . . . is key !

Reflection – Do I ...

- Ask myself whether the feedback criteria are clear and unambiguous?
- Explain clearly the criteria that can help them to do a good piece of work?

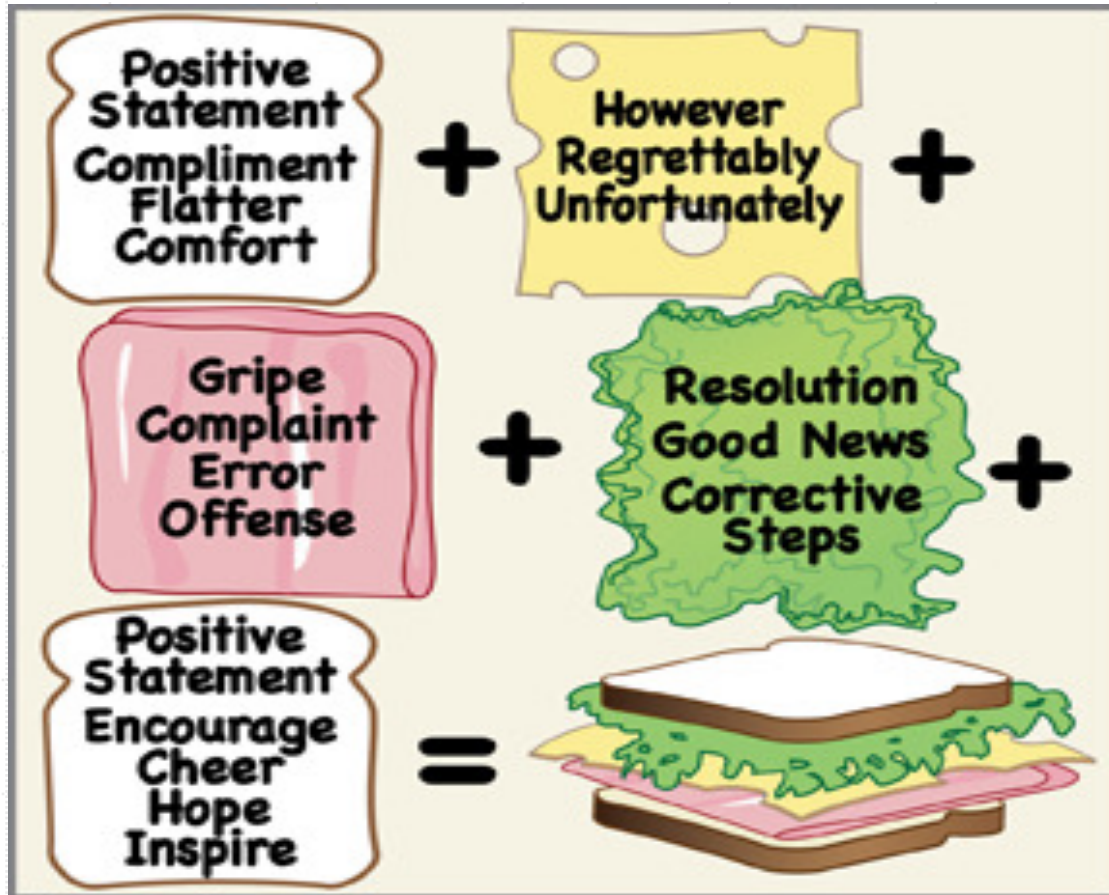


- Recognise the influence of assessment on the students' motivation and self-esteem?
- Appreciate how comments and feedback to students can create a positive or negative culture?

When giving feedback, how much do I:

- Focus on the student's work not on the person?
- Ask the student the reasons behind his/her thinking?
- Give specific ways on how the work can be improved?

The SANDWICH FEEDBACK Technique



Reflect and Discuss

When giving feedback do I:

- Use the “feedback sandwich” concept?
- Give it in a generic way or individually?
- Take into consideration the individual needs of the student?

In conclusion:

- *Allow enough time for students to express fears, doubts, etc.*
- *Invite students to give feedback.*
- *Accept criticism and allow it to support your learning.*

Thank
you!



M M M