Hverdagsforestillinger/ misoppfatninger i naturfag *(Every day concepts of scientific phenomena, misconceptions)*

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Hverdagsforestillinger (Every day concepts)

Begrepet "Hverdagsforestillinger"

- Elever kommer til naturfagundervisning med diverse forestillinger basert på / bygd fra erfaringer.
- Forestillingene er lett å forstå, virker logisk fra elevenes ståsted, men er "feilaktige" eller begrenset fra naturfaglig synspunkt.
- De er temmelig konsistente over tid, og ofte deles av mange.
- De er motstandsdyktige ovenfor undervisning.

Notion of "Every day concepts"

- Students come into science study with an array of preconceptions based on their everyday experience.
- These preconceptions are quite sensible for students, but scientifically limited or incorrect.
- They are often wide spread, shared among many students and rather consistent with time.
- They are therefore resistant to change and create challenges for teaching.

Eksempler (Examples)

Lys

- Elever mener objekter for å "være" en viss farge , og lys kan enten tillate å se fargen eller ikke.
- Studentene mener at man kan se objekter fordi øynene sende ut lys til dem.
- Kun blanke gjenstander reflekterer lys.

Light

- Students believe objects to "be" a certain colour, and light can either allow to see the colour or not.
- Students believe that one can see objects because the eyes send out light to them.
- Only shiny objects reflect light.

Eksempler (Examples)

Krefter

- Krefter betraktes mer som enkelt legemes egenskap enn som *vekselvirkning* mellom legemer.
- Hvis et objekt er i ro, virker ingen kraft.
- Når en gjenstand beveger seg, virker det en kraft som holder det i bevegelse. Gjenstanden stopper når «kraften er brukt opp».

Forces

- Forces are seen as a property of bodies that are forceful rather than *interaction* between bodies.
- When an object is at rest, there are no forces acting on it.
- A moving object carries a force with it that keeps it moving. The object will stop moving when the force is "consumed".

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Embedding assessment in teaching plan

Idea: Backward design approach in lesson planning to embed assessment in teaching

Identify learning intentions
What do we want students to know,
Understand and be able to do?

Evidence of learning
What do we want students to do to
provide evidence of their learning?

Teaching and learning
Which teaching activities will lead
as many
students as possible to complete
the evidence
of learning tasks and questions?

Identifying the tasks and questions is essential for clarifying the learning intentions

Is there a good articulation between the teaching activities and the tasks and questions?

The three stages in the process of backward design based on Wiggins and McTighe (2005)

Embedding assessment in teaching plan (cont.)

Based on the backward design idea, two principle keys to improving learning are (Whitehouse, 2014):

- Having clear and precise learning outcomes
- Monitoring students' learning *during* the teaching process, so that you (or students) can immediately act on what you find.

  → *embedded formative assessment*
  (William, 2011)

Embedding assessment in teaching plan (cont.)

- There are many different ways to embed formative assessment in teaching
- Among others:
  - Diagnostic tasks/ questions
  - Concept cartoons
  - Carefully design resources for self- and peer assessment
  - .....

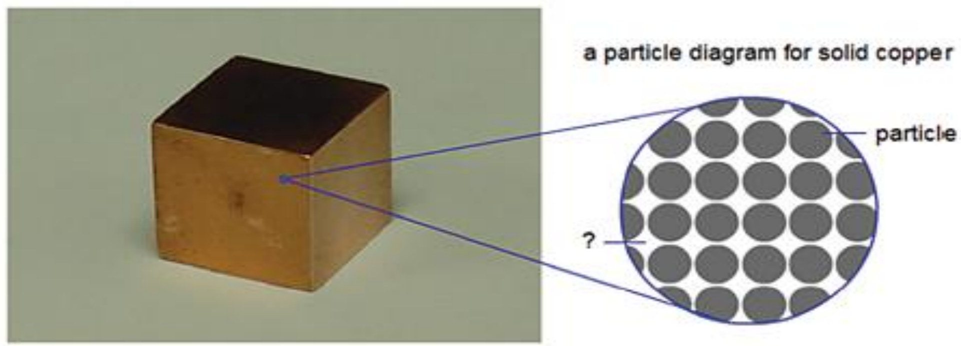
Not only inform the teachers what students already know but also to make students' thinking visible, esp. those struggling

One of the purposes of formative assessment is to discover pre-conceptions , especially those which are scientifically incorrect or limited.

Teachers need to engage those preconceptions if students are to understand science (Donovan & Bransford, 2005)

Example:

Science has the idea that 'stuff' is made of very small particles – too small for us to see. Imagine you could see these particles.



What is between the particles?

A Air

B Solid copper

C Empty space – nothing

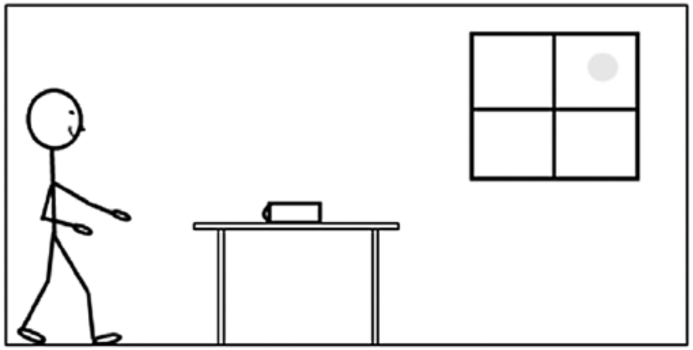
D More particles which aren't shown

Figure 2 A diagnostic question to explore students' understanding of the particle model of matter

From Whitehouse (2013)

Example:

Imagine you are in a room lit by sunlight and you are looking at a book on the table.



Whitehouse (2013)

1 Light travels out in all directions from the Sun.

2 Sunlight passes through the window into the room.

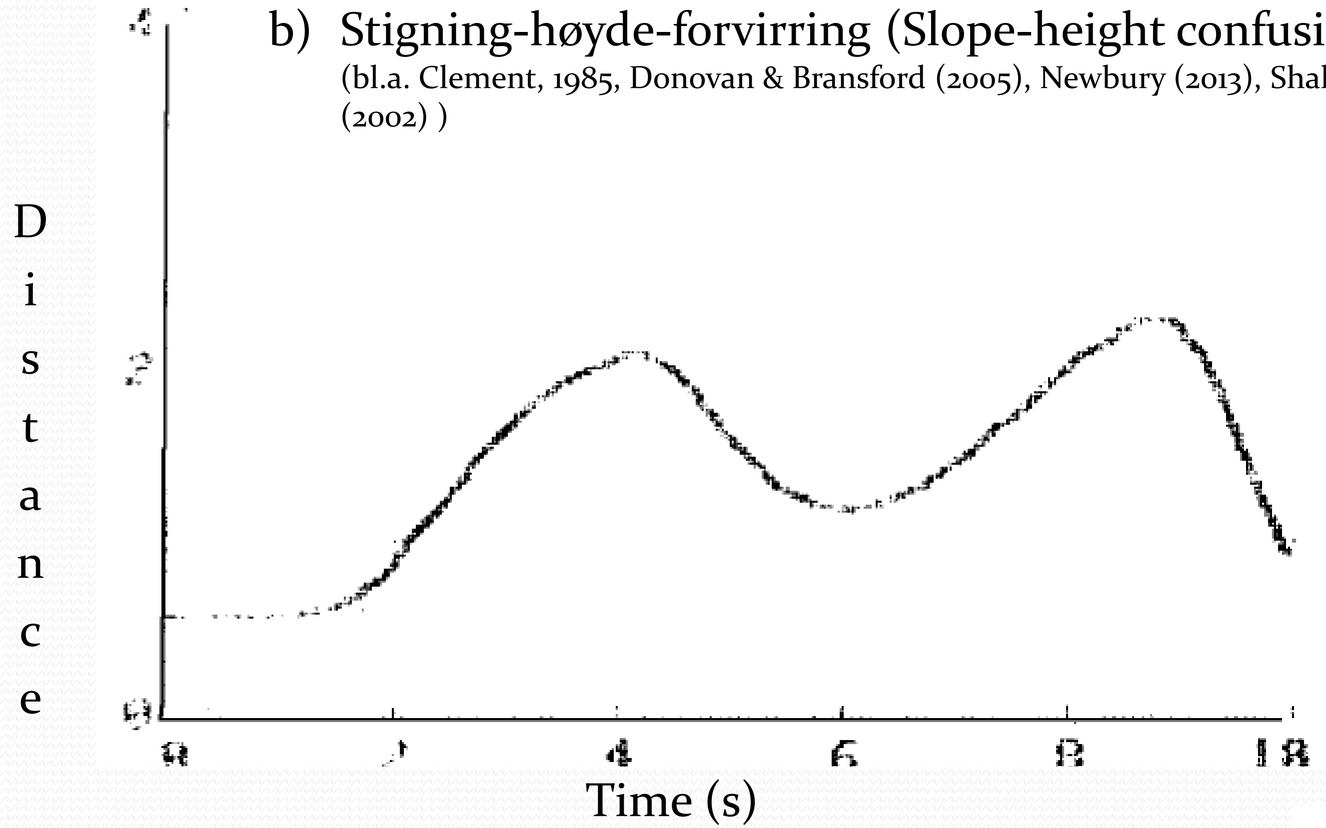
3a Some of this light from the Sun falls on the book.	3b Some of this light from the Sun goes into my eyes.	3c Sunlight fills the room and makes it bright.
4a Light is emitted by the book.	4b Light is scattered by the book.	4c Light is absorbed by the book.

5a As a result, some light travels from the book to my eyes.	5b At the same time, some light goes from my eyes to the book.
6a I see the book because it is lit up.	6b I see the book because this light enters my eyes.

Figure 4 Diagnostic question to explore students' understanding of the 'passive eye' model of vision

Eksempler på de mest vanligste misoppfatninger om tolkningen av grapher
(Examples of the most common misconceptions on graph interpretation):

a) Graph som bilde (graphs-as-pictures)
b) Stigning-høyde-forvirring (Slope-height confusion)
   (bl.a. Clement, 1985, Donovan & Bransford (2005), Newbury (2013), Shah & Hoeffner (2002))



(Mokros & Tinker, 1987)

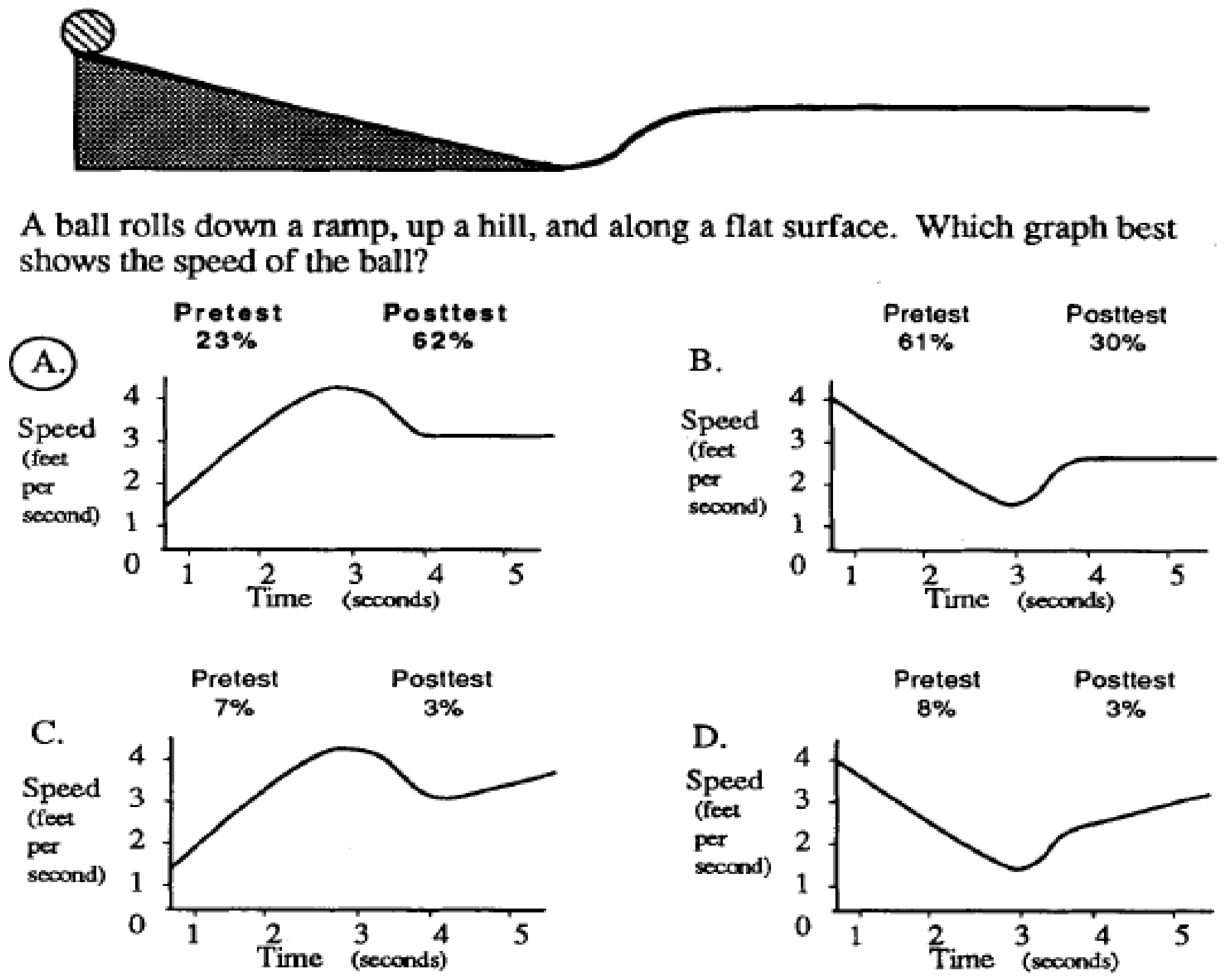


Fig. 3. Ball and Ramp. Percentage of students choosing each alternative.

Intervention: Computer-based real time data gathering and analysis (Bruk av data-loggere) (Mokros & Tinker, 1987)

Jan walks away from a mark on the floor at a steady rate and then walks back toward it.

Which distance graph below would best describe her walk?

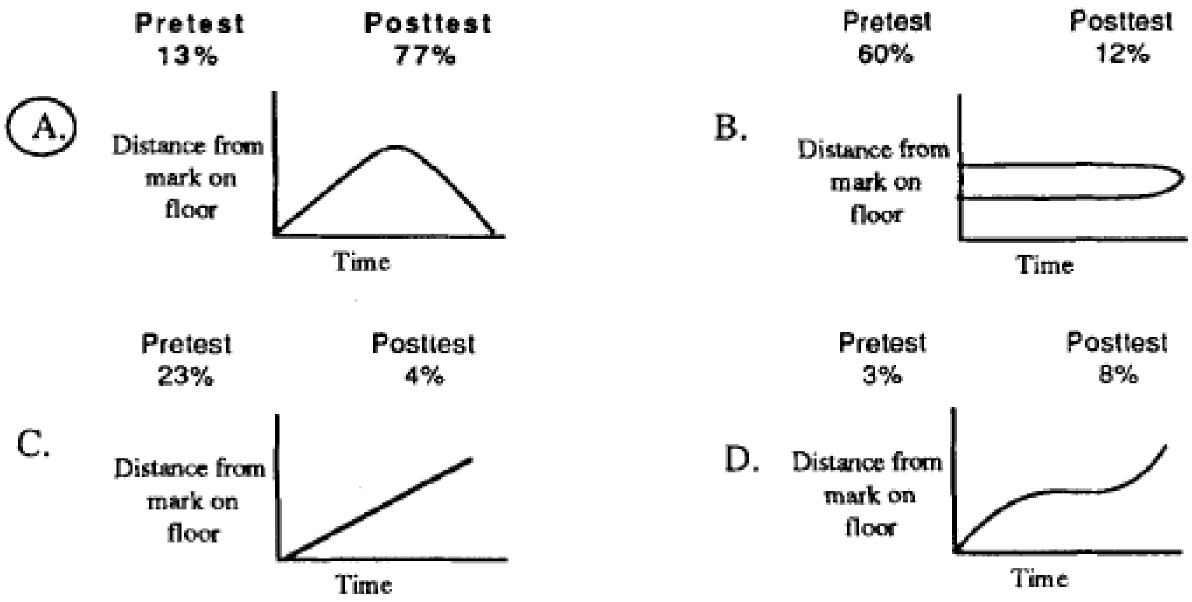
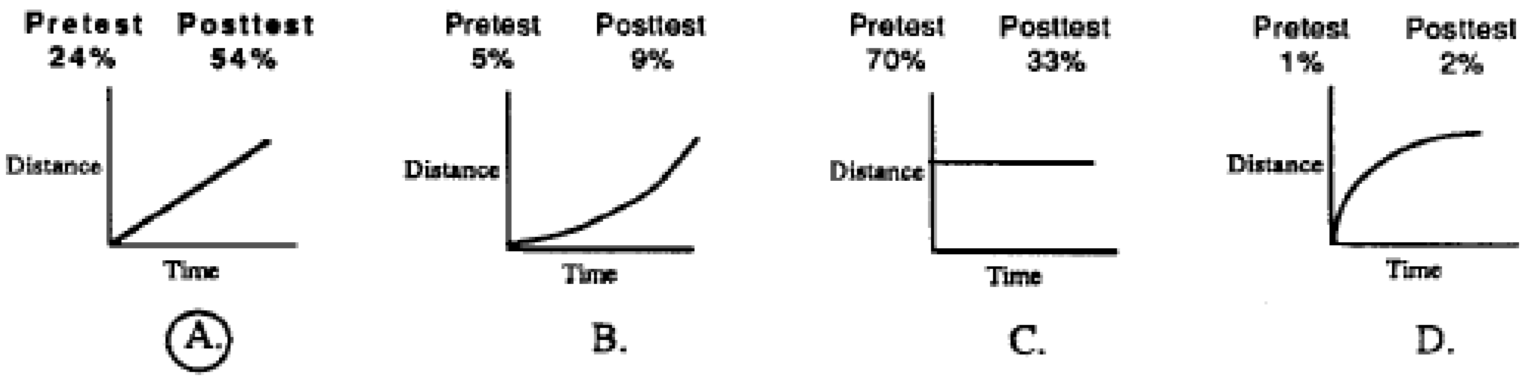


Fig. 4. Jan's Walk. Percentage of students choosing each alternative.

(Mokros & Tinker, 1987)

Which distance graph shows a person moving at a steady speed?



(Mokros & Tinker, 1987)

How can we design tasks and questions that can be used for formative assessment purposes in working with graphs?

How can we embed formative assessment in the planning of lessons?

Comments on embedded assessment.

the key strength of the approach is that it puts assessment for learning right at the heart of the planning process and therefore at the heart of the teaching.

Whitehouse (2013)

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