Didactic method
MISCONCEPTIONS IN PHYSICS

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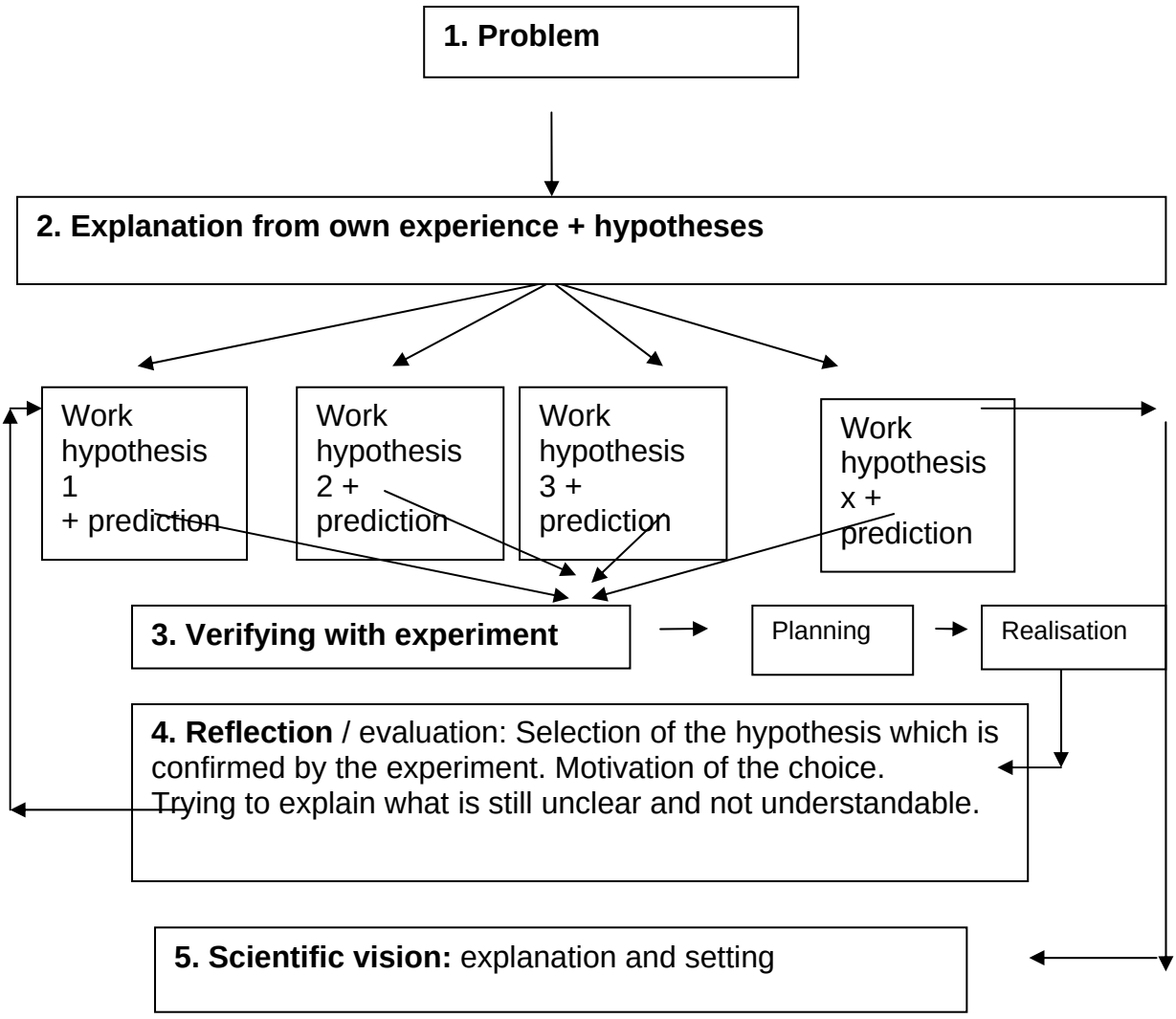
1. Problem
2. Explanation from own experience + hypotheses
Work hypothesis 1 + prediction
Work hypothesis 2 + prediction
Work hypothesis 3 + prediction
Work hypothesis x + prediction
3. Verifying with experiment
Planning
Realisation
4. Reflection / evaluation: Selection of the hypothesis which is confirmed by the experiment. Motivation of the choice. Trying to explain what is still unclear and not understandable.
5. Scientific vision: explanation and setting

Use of the schedule in a class situation

1. Problem, show a cartoon or do an experiment

2. Trying to give an explanation from the own experiences and formulating a work hypothesis

Students:
- They receive the cartoon or the teacher does an experiment…
- They get the time to discuss with 3 or 4 about the content of the cartoon or the experiment.

It is meant that the different preconceptions in the different groups are located. It is certainly that not all the groups come to the same conclusion. The teacher can let it write down on paper so that they have a base for verbal class discussion later. It is important that they try to say it in words, not necessarily correct.

Teacher:
In the groups:
As a teacher we stay in the background!!
If the discussion in the group stops and goes to another subject… then you must go to the group and stimulate the discussion to ask different questions such as. '*What do mean, is this exact, why do you think that, how can you say that, how do you write that down'.* But don't give any answers!, it's their discussion, they must find it.

In the discussion with all the groups
All the groups must tell their opinion!! It is important that the students see that not every one has the same vision and the same preconceptions. It is also important that the students exercise in explaining their own vision.
As an aid you can write down the different visions and put some conclusions on the board from each group. It is not important that the right vision is highlighted!!

3. The experiment

Students:

As a teacher we plan the experiment ourselves and let the students do it. That is wrong because the planning of an experiment is essential in the scientific method, that's why they must plan it by themselves!!
An experiment is not a receipt that we must follow but a mean to answer questions.

In the first phase they must plan and base themselves on their own information of the different senses.

In the second phase they must translate the problem in measurements. They must see what the aim of the measurement is and they must have an idea of the fault of the measurement.

As an aid for the planning you can use the following structure:

Work hypothesis	What is the exact question?
How do we do the experiment and a simple drawing	What experiment can give answer at the question?
Materials	What material do we need?
Procedures	How will we proceed?

First planning and then realisation, that's how you force the students to think first and do afterwards, the results of the experiment, will be clearer.

Give attention to the fact that the students must pen down their measurements
Mostly they don't see the aim, they think the experiment itself is more fun!!

Teacher
Students must learn to plan. As a teacher you must stimulate this process by asking questions such as:

- *What factors have influence on the problem?*
- *What factors have great influence and what have small influence?*
- *Can we presume that some factors are constant?*
- *How will we control some factors?*
- *What quantities correspond to these factors?*
- *How big will be these quantities?*

- *What instrument do you use to measure the quantity?*
- *How will you proceed?*
- *What material do you need?*
- *Why doesn't it work?*
- *What is your conclusion?*
- *…*

You are the coach who is throwing the ball when he is out!!

4. Reflection: Selection of the work hypothesis which is confirmed by the experiment. Motivation of the choice.
Explaining what is not comprehensible.

5. Scientific vision: explanation, clearances, pointing

At the moment that they have an experiment with the right hypothesis then the students are intellectually challenged and they don't have a reason why that is so. Now you can give and bring up the scientific vision of the experiment.

Scientific explanation must be given from the problem and not from school planning, which is off course very adequate but doesn't follow .students thoughts.

Scientific explanation must start from concrete problems (context) and from a conception view it must end in a mathematic formulation.

Scientific explanation must be brought very well because it must overgrow the existing misconceptions.

Sources

- 'Making sense of secondary science' Rosalind Driver Ann Squires Peter Rushworth Valerie Wood –Robinson ISBN 0-415-09767-3
- Conceptual Physics 10th edition Paul G. Hewitt ISBN 0-321-31532-4
- Practicing physics Paul G. Hewitt ISBN 0-8053-9198-3
- Media Workbook Abigail Reid Mechtenberg ISBN 0-8053-9376-5
- Conceptual physics 9th edition Paul Robinson ISBN 0-321-05205-6
- Conceptcartoons with text of John De Poorter (Arteveldehogeschool), Christel Balck (KaHo St.Lieven) and Marc Debusschere (Diocesane Pedagogische Begeleidingsdienst Bisdom Gent) with financial support of Wetenschapsbeleid. The aim is stimulating the use of the didactic technique without commercial purpose.
- Original ideas of Brenda Keogh en Stuart Naylor.

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