

# Inquiry based science education as a tool for meaningful learning

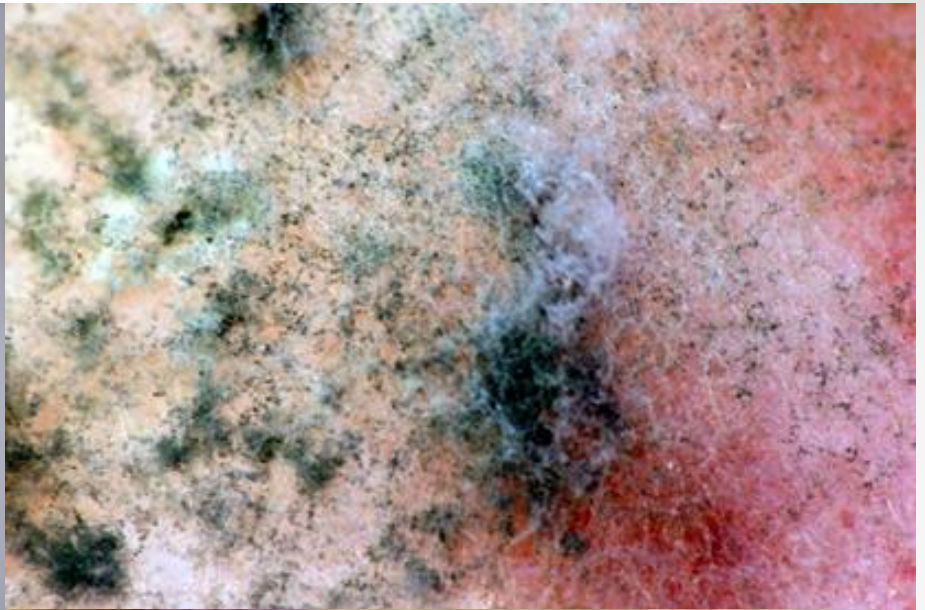


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- Why do we teach science at school?
- Why do people need to learn science (biology, chemistry, physics...)?
- Do you teach pupils that?
- How do you teach pupils that?

# What is inquiry

- **Daily life, education**
- **Seeking knowledge by asking questions.**
- Scientific knowledge – collection of data  
use of evidence



- **Inquiry pedagogy** leads to **understanding concepts** rather than simply memorise them.
- **understanding – facts**
- Importance of **WHAT/WHEN/WHY** questions





# Skills needed in today world

- critical thinking,
- asking questions,
- judging arguments,
- collaborative working,
- consideration of alternatives,
- effective communication...



# Framework of inquiry

## Questions / pupils' prior experience and knowledge

- Starts with questions not answers
- Uses pupils' prior knowledge and experience

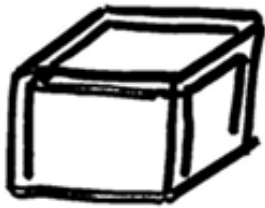


# Ideas about salt

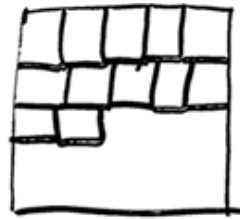
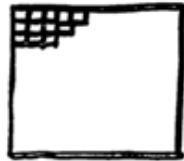
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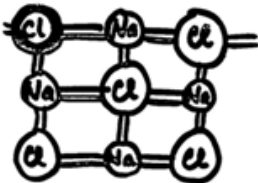
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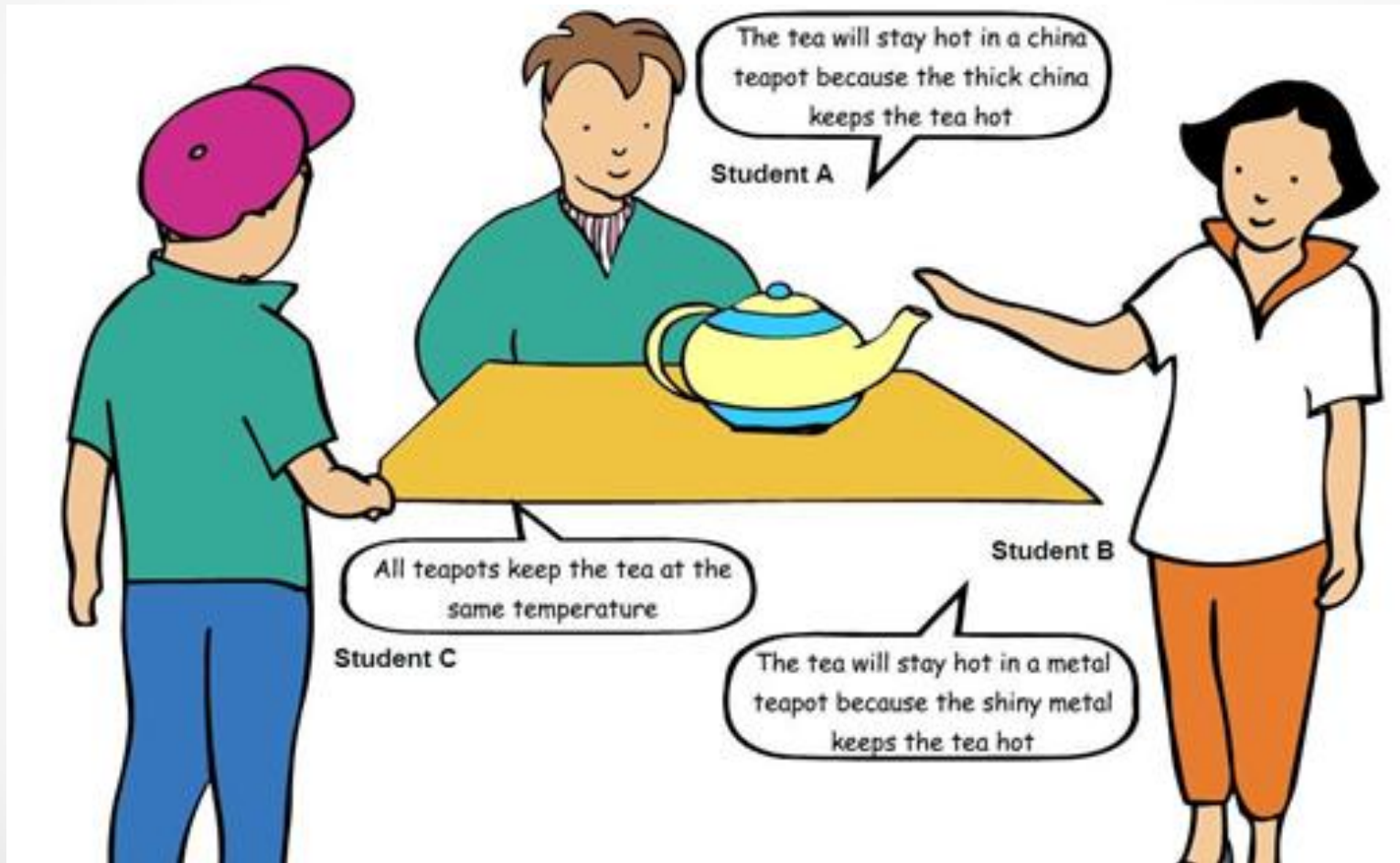
# Prior knowledge

- Preconceptions
- Misconceptions
- Importance to **express prior ideas** about studied phenomenon
- Importance to ask **how they found out**

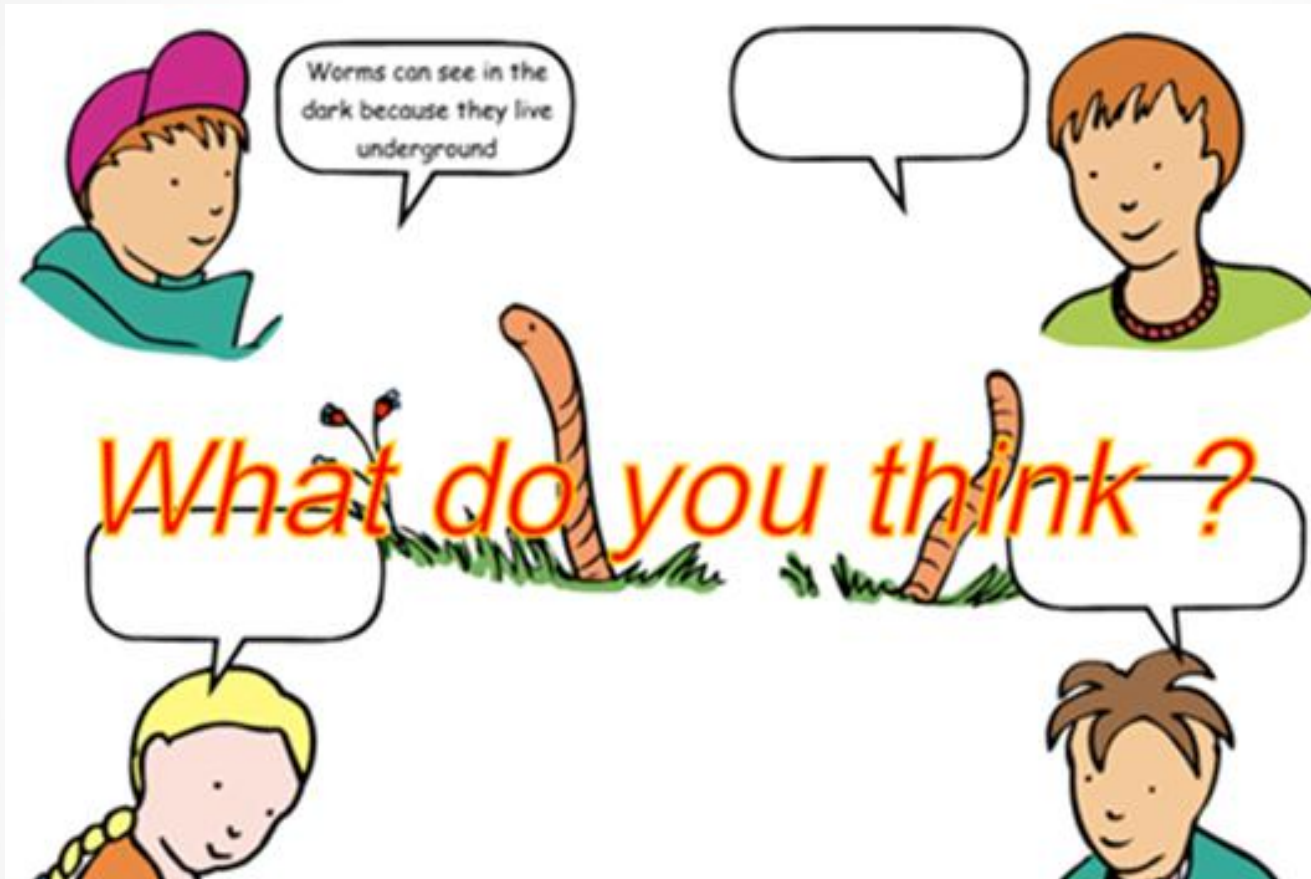
# Seeing for themselves what works rather than just being told

- *The bubbles in boiling water contain “air,” “oxygen,” or “nothing,” rather than water vapor.*
- *Gases are not matter because most are invisible.*
- *Gases do not have mass.*
- *A “thick” liquid has a higher density than water.*
- *Expansion of matter is due to expansion of particles rather than to increased particle spacing.*
- *Particles possess the same properties as the materials they compose. For example, atoms of copper are “orange and shiny,” gas molecules are transparent, and solid molecules are hard.*
- *Chemical changes perceived as additive, rather than interactive. After chemical change the original substances are perceived as remaining, even though they are altered.*
- *Objects float in water because they are lighter than water.*
- *Objects sink in water because they are heavier than water.*
- *All metals are strongly attracted by magnet.*

# Questions



# Questions



# Making predictions

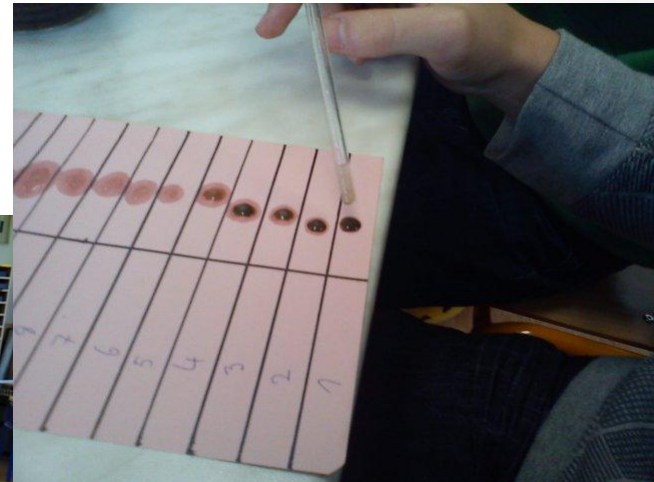
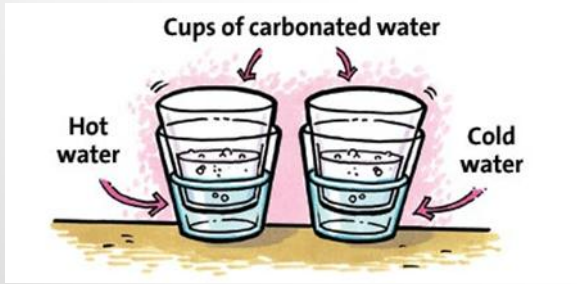
- It is **not a guess**.

**“What makes you think that?”**

- “I think it might be...”
- “I’ve seen something like this when...”
- “It’s a bit like...”

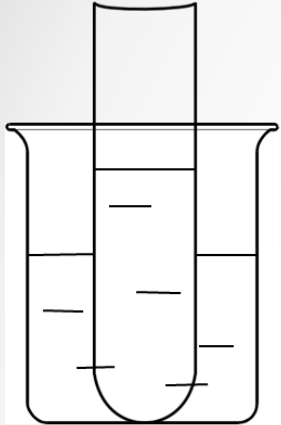
# Testing prediction / planning an investigation

- **comparing** what is predicted with what has been found or observed
- Observation, experiment, literature

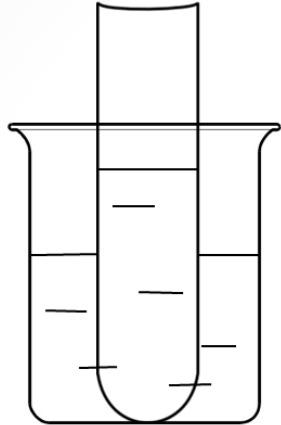




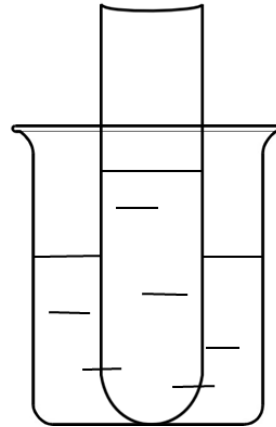
# Keeping records



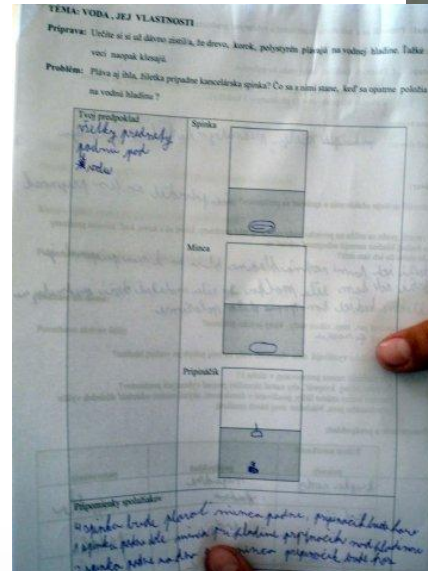
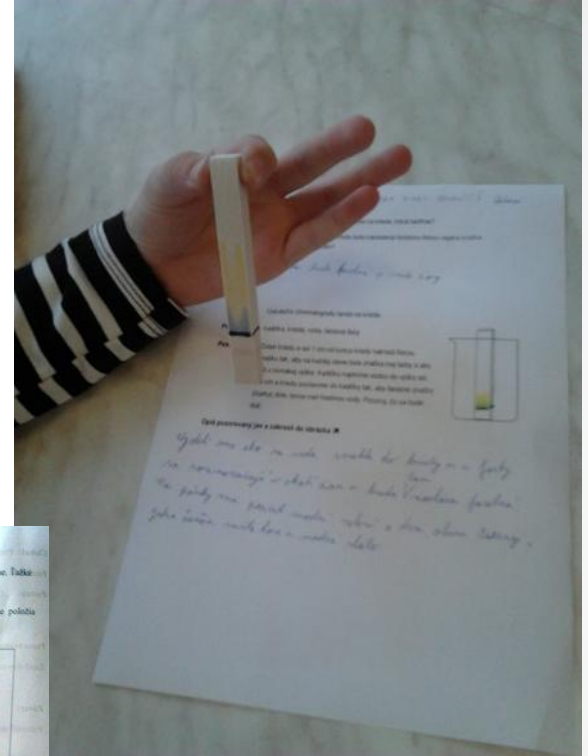
icy water



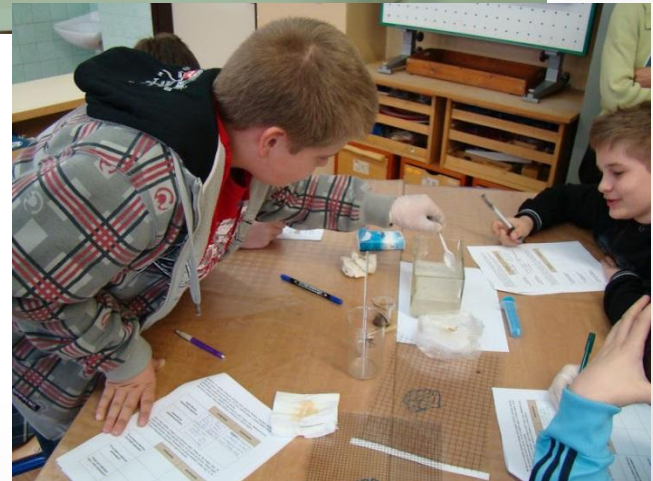
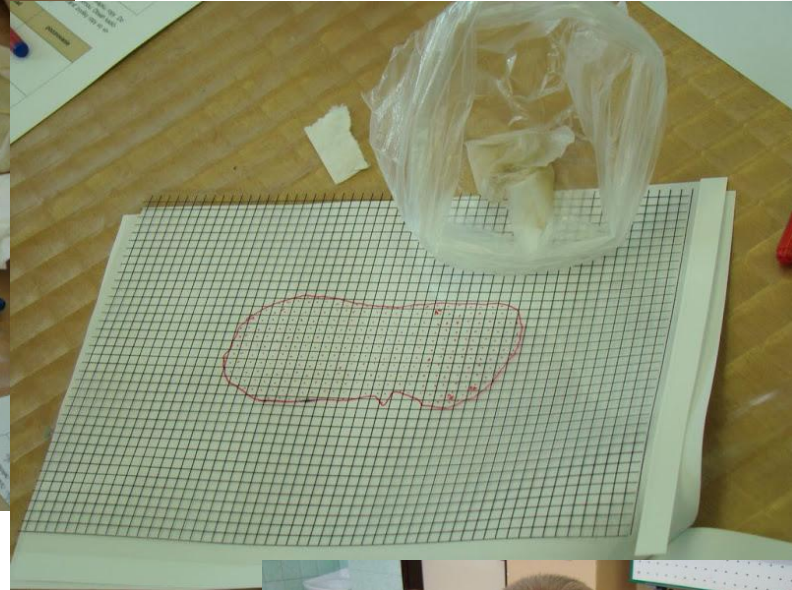
room temperature water



hot water



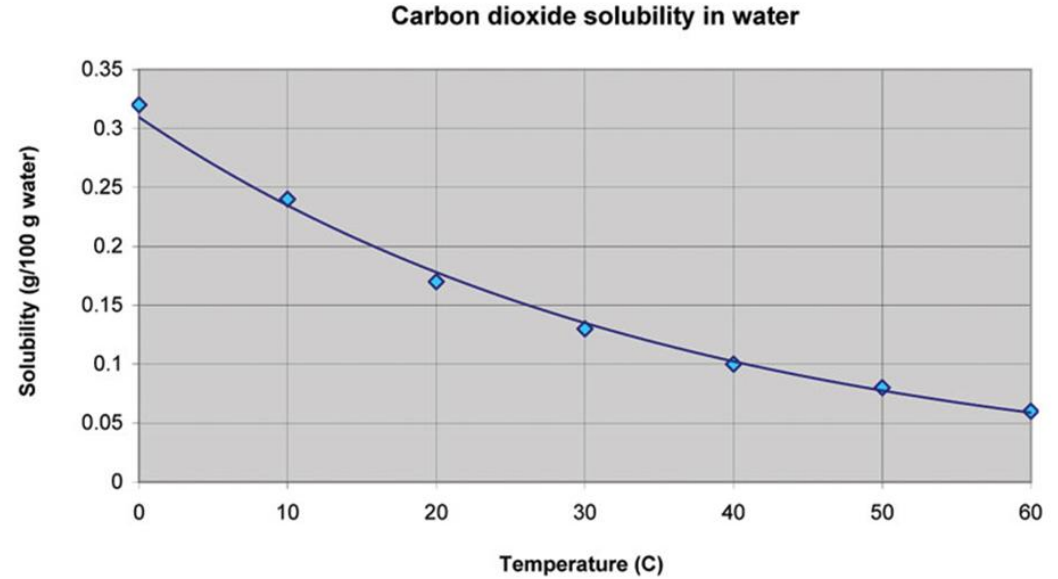
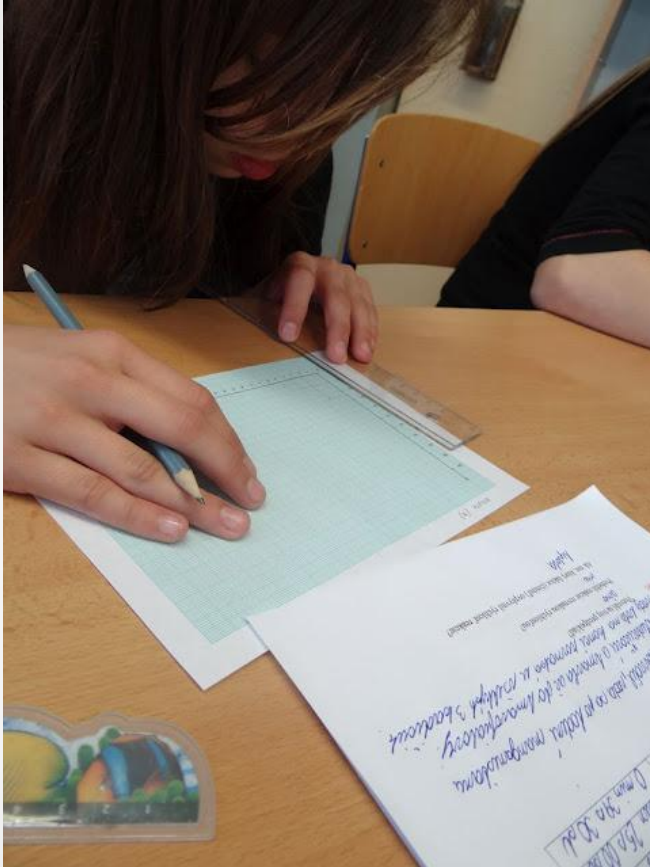
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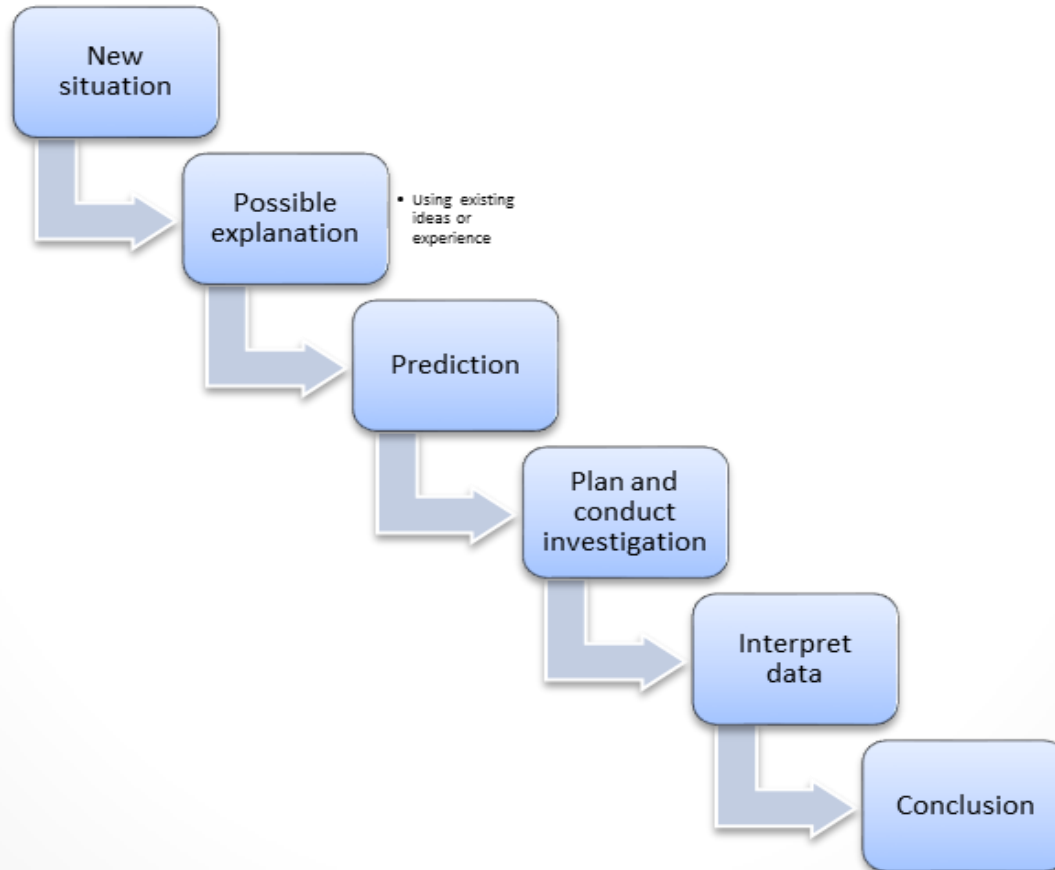
# Data interpretation

- Expressing relation among variables we observed.
- Return to prediction and confront with them.

# Conclusions



# Framework for inquiry





# Discuss

## ENGAGE

What can I try? What do I wonder about? What do I already know?  
What is interesting?

## DESIGN AND CONDUCT SCIENCE INVESTIGATIONS

### Plan and design

What is my question or problem? What do I want to know? How will I find out?

### Formulate new questions

What questions do I still have? What new questions do I have? How can I find out?

### Implement

What do I observe? Am I using the right tools? How much detail do I need to record?

### Draw tentative conclusions

What claims can I make? What evidence do I have? What else do I need to know?

### Organize and analyze data

How do I organize the data? What patterns do I see? What relationships might there be? What might this mean?

## DRAW FINAL CONCLUSIONS

What do we know from all our investigations?  
What evidence do we have to support our ideas?

## COMMUNICATE WITH OTHER AUDIENCES

What do I want to tell others?  
How will I tell them? What is important to include?

# Record

Share

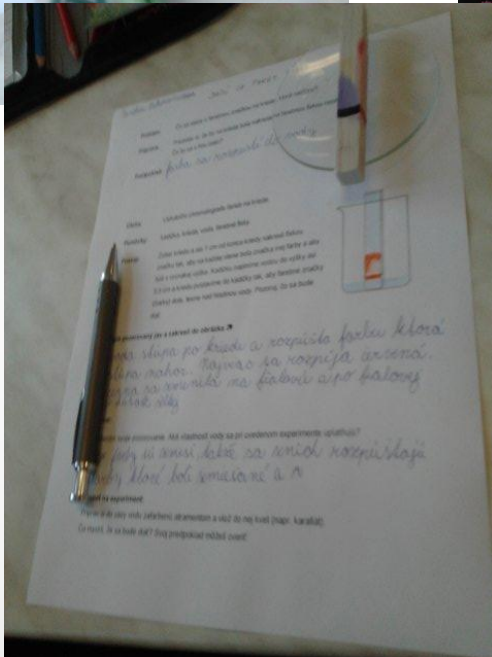
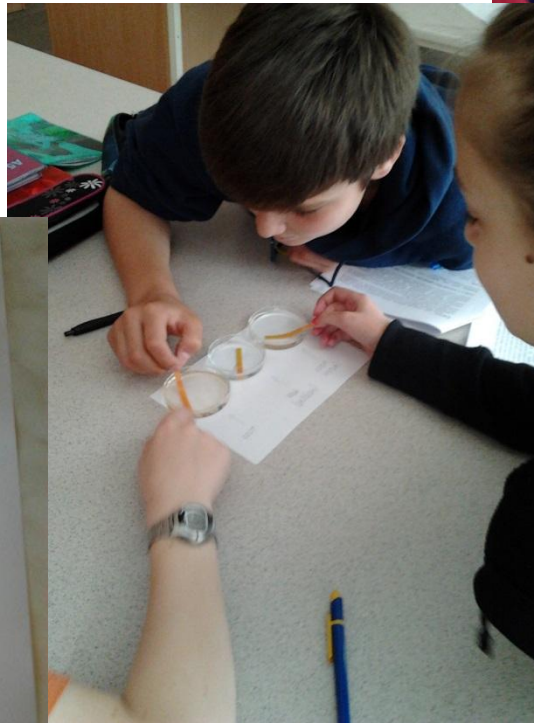
Debate

Reflect

Cooperate



# Enjoyment and satisfaction



# Building a bigger ideas

Small ideas



Big ideas

Developing progressively more powerful ideas about the world around.

- increasing ability to consider that properties may be explained by features that are not directly observable;
- greater recognition that several factors need to be understood if phenomena are to be explained;
- greater quantification of observations, using mathematics to refine relationships and deepen understanding;
- more effective use of physical, mental, and mathematical models



# Developing the skills needed in scientific inquiry through participation in it

- Learn what is important to observe.





# Realising that learning science involves discussion and working with and learning from others



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