Observation of Air Extracts in Primary Schools

A simple observational project in which pupils work with samples and learn to think scientifically.

1. Purpose of the project

The project enables pupils to observe real samples (‘air extracts’) from different locations and keep systematic records of them. The aim is not to draw medical or legal conclusions, but to teach pupils to:

- distinguish an observation from an assumption and a hypothesis
- work with measurements and simple indicators (e.g. visual changes, time, comparison of samples)
- keep a protocol and photographic documentation, as in a laboratory
- evaluate information critically and communicate the result clearly

2. What the school receives

The delivery for the school is prepared so as to place the least possible demand on teachers.

- prepared samples labelled with a code and date (comparison sets)
- a simple protocol for pupils (A4 – completing fields, without writing ‘essays’)
- an observation diary template (time points: day 0, day 1, day 3, day 7…)
- safety and hygiene rules (concise and suitable for schools)
- an output template: poster / presentation / short report

3. Minimum work for the teacher

The teacher’s role is primarily organisational. The project is designed so that the teacher does not have to do the science ‘for the pupils’.

What the teacher actually does

- sets aside a place to store the samples (e.g. a shelf in the classroom or subject room)
- supervises the basic handling rules (gloves as instructed, no drinking, no tasting, wash hands)
- sets the observation dates (e.g. 5–10 minutes at the start of a lesson, 2–3× per week)
- at the end, hands in/sends the completed protocols or photographs of the protocols

What the teacher does not have to do

- does not have to mix anything chemically or prepare solutions
- does not have to evaluate anything ‘professionally’ or write conclusions
- does not have to do any additional administration – everything is provided in templates
- does not have to work with artificial intelligence – the pupils do this (if it is part of the lesson)

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4. What the pupils do

1. They receive the samples and set up an observation diary (sample code, date, location in the classroom).
2. On the specified days, they make an observation: appearance, changes, any sediment, film, colour, smell (description only, not evaluation).
3. They take a photograph from the same angle and distance (ideally with a scale or squared paper).
4. They record the result in the protocol and compare the samples with one another.
5. At the end, they prepare an output: a short report or poster (what they saw, when it changed, what is the same/different).

5. Skills the children will gain

- a scientific method of working: recording ☐ comparison ☐ repeatability
- discipline in measurement: the same conditions, the same time points
- working with data: simple tables, time series, photographic documentation
- media literacy: the difference between fact and interpretation
- basic work with artificial intelligence: how to ask questions, how to verify information, what is a hallucination and what is a source

6. Safety and boundaries of the project

The project is observational. No health claims or diagnoses are made in the school environment. Pupils learn to describe precisely what they see and what they cannot confirm.

- The samples must not be tasted or drunk.
- Handling takes place in accordance with the school's hygiene rules.
- Conclusions are phrased cautiously: 'we observed', not 'we proved'.

7. Advantages and disadvantages (a fair summary)

Advantages

- a real, tangible experiment – pupils see that 'air is not empty'
- a low workload for teachers thanks to prepared templates
- links science, chemistry, physics, computing and citizenship education
- can be carried out in an ordinary classroom without a laboratory

Disadvantages / limitations

- observation alone is not a chemical analysis – the results have limited evidential value
- if the same photography and timing conditions are not maintained, the comparison deteriorates
- some phenomena may have several explanations (both biological and non-biological) – cautious interpretation is therefore taught

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8. Time required (indicative)

- Starting the project in the classroom: 15–20 minutes (explanation + setting up the protocols).
- Routine observation: 5–10 minutes according to the schedule.
- Final output (poster/presentation): 1 lesson (or as homework).

9. Outputs for the school and its leadership

- completed protocols (evidence of the pupils' work and a measurable project output)
- photographic documentation from the same time points
- a concise final poster / presentation (also suitable for Earth Day or a school project day)

10. Contact and next steps

If the school expresses an interest, the samples, templates and brief instructions for organising the project in the classroom will be supplied. The aim is for the project to be launched without lengthy preparation.

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Project Supplement: Critical Thinking and Working with Information

This follows on from the document ‘Observation of Air Extracts in Primary Schools’

1. Why this supplement exists

This supplement explains how the air-extract observation project purposefully develops pupils’ critical thinking. It is based on a simple scientific principle: observation, recording and comparison. The result is not known in advance, so pupils cannot ‘follow a recipe’ – they must work with evidence, not impressions.

2. Critical thinking: what it is (and what it is not)

Critical thinking in this project means the ability to: (a) separate observation from interpretation, (b) determine what we can safely assert and what is merely an assumption, (c) assess the quality of evidence and (d) acknowledge uncertainty where the evidence is insufficient.

It is not ‘looking for faults at any cost’, nor does it mean automatically questioning everything. It is a disciplined way of guarding against our own biases and drawing conclusions proportionate to what is actually observed.

3. Observation vs assumption (the most important distinction)

Pupils learn to write two separate sentences:

- Observation: what I see / what I can measure (e.g. colour, deposit, film, time of change, TDS, pH).
- Assumption: what I think it might be (e.g. ‘it may be…’).

This simple distinction is a practical safeguard against an assumption being presented as fact.

4. Biases and common errors that can be identified here

The project naturally demonstrates how biases arise:

- Confirmation bias: I notice only what supports my initial idea.
- Confusing correlation with causation: ‘it happened at the same time, so it caused it’.
- Premature conclusion: I reach a conclusion before I have enough observations.
- Authority effect: I believe it because someone ‘important’ said it, not because there is evidence.

In the project, these errors are addressed by keeping a record of evidence and comparing samples between classes/schools.

5. Hoaxes and resilience to disinformation: what pupils actually learn

The project does not train pupils to hold the ‘right opinion’. It teaches them a process for working with a claim:

- What exactly does the claim say (is it measurable, or is it merely a slogan)?
- What evidence would support it, and what evidence would refute it?
- What are the alternative explanations for the observed phenomenon?
- What is already a fact (observation), and what is still a hypothesis (explanation)?

This is how resilience to hoaxes is developed: not by telling pupils ‘do not believe it’, but by teaching them how to verify it.

6. Why this is serious scientific work even at primary-school level

The scientific nature of the project does not depend on a complex instrument, but on its methodology:

- Repeatability: the same procedure in different classes/schools.
- Documentation: photographs, dates, basic measurements and notes.
- Comparison: a control sample (e.g. distilled water) and the samples under investigation.
- Working with uncertainty: conclusions only within the limits of the evidence.

The key difference from stereotypical ‘chemistry experiments’ is that the result is not known in advance and the pupil is not reproducing an expected effect. Instead, the pupil observes and evaluates.

7. What pupils will gain (competences)

- Recording skills: keeping an observation diary and working with dates/time.
- Basic data skills: simple tables, comparing trends, describing without exaggeration.
- The language of precision: expressions such as ‘we observe’, ‘we assume’, ‘we cannot determine’.
- Basic work with artificial intelligence: asking questions in a way that makes the answer verifiable, and checking outputs against their own observations.

8. Outputs for the school

The output may take the form of a class or school ‘observation record’: a concise report with photographs, a table of measurements and a separation of observations from hypotheses. It may also be used for comparisons between schools.

9. One sentence for the school leadership

The project teaches pupils to observe scientifically and distinguish facts from assumptions; in doing so, it naturally increases their resilience to bias and disinformation, while the result is not predetermined.

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STANDARDISATION OF INPUT MATERIAL, QUALITY CONTROL AND THE SCIENTIFIC FRAMEWORK OF THE IIIT® PROJECT

This document is intended for school leadership, teachers, parents and project partners. It explains in detail why standardisation of the input material is essential, how comparability between schools is ensured, why quality control is crucial when working with samples, and the scientific framework within which the project operates – without disclosing internal details of how the IIIT® module functions.

1. WHY STANDARDISING THE INPUT IS A CONDITION OF FAIRNESS AND COMPARABILITY

If results from different schools are to be comparable, whatever the experiment has in common – namely, the input material – must be controlled. In this project, the input is the extract with which pupils work. If every school used a different method to prepare or obtain the sample, the results would differ not only because of the environment (which is the purpose of the observation), but also because of the methodology itself (which is an undesirable confounding factor).

From a scientific perspective, this is a fundamental rule: to compare outputs, we must control inputs. Otherwise, the project becomes a collection of incomparable experiments in which it is impossible to determine whether a difference was caused by the environment, the sampling time, or merely a different method of obtaining the sample.

The project is therefore correctly designed so that all schools receive samples prepared using the same technology and to the same quality standard. The comparison is then fair: everyone starts from the same 'starting point'.

2. WHY EACH SCHOOL CANNOT COLLECT 'DIFFERENT MATERIAL'

If each school collected material differently (e.g. steam condensate on one occasion, air condensate on another, random water or another type of collection), the actual subject of observation would change. Some materials may be 'poor' in ultrafine fractions or reactive substances. Aggregates or visible changes may then form very slowly, weakly or not at all.

This has two consequences:

- scientific: the results can no longer be compared and interpreted,
- educational: pupils may feel that they are doing everything correctly, yet 'nothing is happening', which reduces motivation.

Scientific work always involves uncertainty, but a school project must also ensure that, when the correct procedure is followed, the observer has a real chance of seeing an interesting phenomenon sooner or later. This is particularly important for younger pupils, for whom the first 'moment of discovery' is decisive.

3. QUALITY OF INPUT = QUALITY OF PUPILS' WORK (WHY THIS IS NOT A DETAIL)

It is important to state openly: the quality of the pupils' work may be excellent, but if the input material is poor-quality, inconsistent or contaminated, the result may be weak. That is not the pupils' fault. It is a characteristic of the experiment: the input strongly influences the output.

Standardisation and sample control therefore have a direct impact on the fairness of the project. If pupils are to be assessed (observation, recording, patience, analysis), they must not be disadvantaged because they received an inferior input.

4. CROSS-CONTAMINATION AND SECONDARY CONTAMINATION – WHY THIS IS CRITICAL

When working with samples, there are two types of undesirable influence:

- cross-contamination: the transfer of material from one sample to another,
- secondary contamination: the sample being affected by the environment, the container or handling.

In practice, this may be caused, for example, by:

- reusing a container without thoroughly cleaning it,
- using the same materials (e.g. spoons, pipettes) between samples,
- storage in warmth, in sunlight, or near sources of odours or chemicals,
- touching, dust, a kitchen environment, unsuitable closures,
- mixing samples 'just for a moment' without recording it.

The result is the emergence of changes that are not caused by the original sampling environment, but by handling. This is a problem both for scientific value and for pupil motivation, because it reduces confidence in the result.

The project therefore requires simple quality rules: uniform containers, uniform labelling, a handling record and basic discipline during work. This is not bureaucracy – it is about protecting the result.

5. SCIENTIFIC FRAMEWORK – WHAT WE SHARE WITH MODERN PRACTICE (WITHOUT DETAILS OF THE MODULE)

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In the field of ultrafine-particle measurement, conventional, simple procedures often cannot work with the finest fractions in a way that makes them both observable and analysable. Modern practice therefore uses procedures and systems that make it possible to transfer information about the ultrafine fraction into a form with which further work can be carried out (capture, observation, analysis).

In this project, it is defensible to state that we are working with the ultrafine fraction and its manifestations in the condensate because we have measurable supporting evidence:

- analytical support: electron microscopy (SEM/EDS) confirms the presence of solid structures and elemental composition,
- process support: Protocol 307 documents significant changes in selected gaseous parameters (e.g. CO), which is consistent with transformation processes, not merely passive capture.

This leads to a scientifically defensible conclusion: the extract is a carrier of substances and ultrafine fractions, which may then manifest over time through the formation of aggregates and observable changes.

6. WHY DIFFERENT AGGREGATES FORM ACCORDING TO THE PLACE AND TIME OF SAMPLING (AND WHY THIS IS MEASURABLE)

The composition of air is not the same everywhere and at all times. It changes according to nearby sources, the weather, traffic, industrial activity, combustion and the season. This means that even where the types of substances are similar (e.g. mineral dusts, metallic particles, organic constituents), their quantities and proportions may differ significantly.

A practical example:

- Mountain air may have a relatively higher proportion of natural mineral particles and a lower proportion of combustion-derived constituents.
- An industrial zone may have a higher proportion of metallic fractions, specific aerosols or secondary particles.
- Engine exhaust is specific in that it contains a significant proportion of combustion products and ultrafine particles.

For this reason, it is scientifically reasonable to expect that extracts from different places and times will:

- have some common features (because many constituents recur in the air),
- but differ in the proportions of the substances and particles present.

This difference in proportions will subsequently manifest as a different type of aggregation, a different appearance, a different rate of change and different observation dynamics.

This is measurable and repeatable, provided that the following are maintained:

- a uniform input (the same acquisition technology),

- a uniform observation protocol,
- a record of the place and time of sampling,
- discipline to prevent contamination.

7. CONCLUSION – WHY INPUT QUALITY IS WORTH LOOKING AFTER

Standardisation of the input material is not a ‘detail’. It is a fundamental prerequisite for the project to function:

- scientifically (comparability, interpretation, reproducibility),
- educationally (motivation, the moment of discovery, fairness),
- organisationally (simple rules, clear procedures).

If the input material is uniform and of high quality, pupils have a better chance of achieving an observable result that they can then repeat, compare and explain. This is the essence of experiential science.

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THE EDUCATIONAL PHILOSOPHY OF THE PROJECT

This project is designed as a long-term educational process, not as a one-off experiment. Its purpose is not to produce a dramatic discovery or confirm an expected result in advance. Its purpose is to develop a way of thinking – systematic, critical and responsible.

At a time when children are exposed every day to large amounts of information, instant opinions and ready-made interpretations, it is exceptionally important to create a space at school where they learn to work slowly, precisely and verifiably. This project creates such a space.

The project as training in thinking

Observation is the foundation of the project. Not evaluation, not interpretation, but observation. Pupils learn to separate what they actually see from what they think. They learn to record facts, identify uncertainty and formulate hypotheses without presenting them as definitive conclusions.

This approach develops the ability to work with complexity. The world is not black and white, and most situations do not have an immediate solution. A child who learns to respect the process of discovery acquires the ability to think more deeply and responsibly.

There is no good or bad result

The project does not assess a result as 'good' or 'bad'. It assesses the quality of the process. If nothing changes on a given day, that is a valid output. If a pupil makes a mistake in a hypothesis, that is a natural part of learning. An error is not a failure – it is information.

This approach builds resilience to frustration. Pupils realise that progress does not arise from one great success, but from gradual improvement and repeating the basic steps.

Working with artificial intelligence as modern literacy

The project also develops the ability to work with artificial intelligence. AI is not a source of ultimate truth, but a tool for generating hypotheses, calculations or proposed explanations. Pupils learn to ask precise questions, record the answers and then compare them with real observations.

In this way, digital literacy based on a critical approach is developed. Children learn that even modern technologies can be helpful only when used responsibly and sensibly.

Interdisciplinary links

The project naturally links several subjects: science, chemistry, physics, mathematics, computing, language and media education. Pupils gradually build a framework of connections – they understand that precise measurement is linked to mathematics, clearly articulating an idea is linked to language, and critically evaluating information is part of media literacy.

Such links create a stronger foundation of knowledge. Foundations upon which the future can be built – whether for further study, a specialist direction or practical decision-making.

A perspective for the future

The project looks towards a future in which people capable of thinking independently, working with data, asking questions and distinguishing between fact and opinion will be valued. It does not teach children only specific content, but a way of working that is transferable to different areas of life.

Gradually developing patience, precision and responsibility creates the basis for a more stable and considered approach to decision-making. Such skills are the foundation of both personal and professional maturity.

Summary: This project is an investment in a way of thinking. It does not provide ready-made answers, but teaches how to arrive at them. Honesty, discipline and the ability to learn from the process are assessed. This is a solid foundation upon which further education and future direction can be built.

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THE IIIT® PROJECT – LEGISLATIVE, SCHOOL AND LOCAL-GOVERNMENT FRAMEWORK (SR)

This document provides a detailed legislative and systemic basis for the IIIT® project under the conditions of the Slovak Republic. It is intended for school leadership, school founders (municipalities and towns) and territorial self-government authorities. The document is based on the applicable legislation of SR and the current State Educational Programme (ŠVP 2023).

1. ACT č. 245/2008 Z. z. (Education Act)

Under § 2 of the Education Act, the aim of education and training is to develop critical thinking, the ability to solve problems and apply knowledge in practice. The IIIT® project fulfils these aims through experimental observation and work with data.

Under § 6 and § 7 of the Education Act, a school creates its School Educational Programme (ŠkVP) on the basis of the State Educational Programme. The project may be included as an interdisciplinary activity, project-based learning or an extended thematic unit without the need to alter the compulsory ŠVP framework.

2. STATE EDUCATIONAL PROGRAMME (2023)

The project directly concerns the educational area 'People and Nature' (biology, physics, chemistry), as well as the area 'Computing and Working with Information' and the development of key competences (critical thinking, working with evidence, digital skills).

The ŠVP emphasises the development of scientific thinking, the ability to formulate hypotheses, work with data and distinguish between fact and opinion. The IIIT® project develops these principles systematically.

3. ACT č. 596/2003 Z. z. (state administration in education and self-government)

Under Act č. 596/2003 Z. z., municipalities and towns are the founders of primary schools. They have the right to support development and innovation projects that improve the quality of education. The IIIT® project is conceived as a development activity aligned with the aims of improving the quality of the educational process.

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The project may be implemented without interfering with the school's organisational structure and without the need to approve a legislative change to the curriculum.

4. ACT č. 597/2003 Z. z. (school funding)

The project may be funded from the school's budget, from the founder's resources or through grants and development programmes. The project is scalable and allows gradual implementation without a significant financial burden.

5. ACT č. 124/2006 Z. z. (occupational health and safety – BOZP) and Act č. 355/2007 Z. z. (public health)

The project does not require the handling of hazardous chemical substances in the school environment. When working with samples, the general principles of occupational safety and the school's internal guidelines must be observed.

In the case of biological observations, hygiene rules and the school's internal guidelines must be followed.

6. ACT č. 18/2018 Z. z. (personal data protection – GDPR)

When publishing results on the school's website or social media, the protection of pupils' personal data and the applicable GDPR rules must be respected. The project may be implemented without publishing personal data.

CONCLUSION FOR SCHOOL LEADERSHIP AND LOCAL GOVERNMENT

The IIIT® project can be fully implemented in accordance with the applicable legislation of SR. It is compatible with ŠVP 2023, supports the development of key competences and does not require a change to the curriculum or major organisational adjustments.

From the perspective of a municipality or town as the founder, the project represents an innovative tool for supporting the quality of education, developing pupils' digital and scientific competences and strengthening the school's standing within the region.

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When Foundations Are Enough – Historical Examples and Scientific Thinking

This supplement follows on from the previous documents concerning the project for observing air extracts in primary schools. Its aim is to demonstrate that serious scientific work can begin even in an environment without cutting-edge equipment – provided that the foundations are sound: observation, recording, comparison, and the honest separation of data from assumptions.

1. Why this is scientifically sound (and why it matters to a school)

In the natural sciences, 'being scientific' is not defined by an expensive instrument, but by method. The most fundamental principle is observation. When the result is not known in advance, pupils do not learn a 'recipe'; they learn to work with uncertainty: to measure, describe, use a control, compare, and only then formulate a conclusion.

This is also training in critical thinking: distinguishing what is data (observation), what is interpretation (explanation), and what is merely an assumption. This precise distinction is crucial in practice when dealing with hoaxes and biases – not 'fighting with opinions', but asking: 'What is this based on? Can it be verified? What would refute my conclusion?'

2. Historical examples: people outside hierarchies, minimal resources, major contributions

Below are concise, verifiable examples of people who did not start from an advantageous position. They have one thing in common: they relied on the fundamentals (observation, skill, perseverance, accurate records) and thereby produced work upon which even leading laboratories later built.

Michael Faraday (1791–1867)

- Starting conditions: an apprentice bookbinder (with minimal formal education), he gradually became a key figure in electromagnetism and electrochemistry.
- Why this matters to a school: he focused on experiment, precise observation and simple but rigorous tests; at the beginning, his lecture notes were his 'laboratory'.
- Verification (link):
- Encyclopaedia Britannica – Michael Faraday:

https://www.britannica.com/biography/Michael-Faraday

- Royal Institution – Michael Faraday (profile):

https://www.rigb.org/explore-science/explore/person/michael-faraday-1791-1867

- Science History Institute – Michael Faraday:

https://www.sciencehistory.org/education/scientific-biographies/michael-faraday/

Mary Anning (1799–1847)

- Starting conditions: she came from a poor background, without stable access to formal education; through collecting and interpreting fossils, she made a fundamental contribution to palaeontology.
- Why this matters to a school: she worked in the field with modest tools; patience, attention to detail and repeated collecting over time were the key.
- Verification (link):
- Natural History Museum (UK) – Mary Anning:

https://www.nhm.ac.uk/discover/mary-anning-unsung-hero.html

Gregor Mendel (1822–1884)

- Starting conditions: a monk and teacher; he conducted his famous experiments in a monastery garden – without modern instruments, but with a precise system.
- Why this matters to a school: he established controlled crosses, monitored defined traits and kept systematic records of a large number of observations.
- Verification (link):
- Encyclopaedia Britannica – Gregor Mendel:

https://www.britannica.com/biography/Gregor-Mendel

- Khan Academy – Mendel and peas:

https://www.khanacademy.org/science/ap-biology/heredity/mendelian-genetics-ap/a/mendel-and-his-peas

Srinivasa Ramanujan (1887–1920)

- Starting conditions: he grew up in poverty and studied much of mathematics independently; his results transformed several areas of modern mathematics.
- Why this matters to a school: systematic work with the fundamentals and his own notes; proof that the ‘foundation’ (logic, consistency, discipline) is crucial even without an institution.
- Verification (link):
- Encyclopaedia Britannica – Srinivasa Ramanujan:

https://www.britannica.com/biography/Srinivasa-Ramanujan

3. Connection to our school project: ‘foundations that will not collapse’

Primary school provides the foundations. If they are weak, later work with cutting-edge instruments may also ‘collapse’: a pupil may know how to press a button, but cannot distinguish a measurement error from a difference in the sample, cannot work with a control and cannot separate an observation from the story they add to it.

The observation of air extracts is deliberately designed to give pupils the discipline of scientific thinking: first data (what I see/measure), then comparison (what I compare it with), and only then interpretation (what follows from it). This is a transferable skill – it works in the same way with samples, with articles on the internet and when working with artificial intelligence (AI can create text, but the pupil learns to ask: ‘Is it supported by evidence? Can it be verified? What is fact and what is an assumption?’).

4. Key sentence for the school leadership

The project is based on minimal intervention by the teacher: the teacher is not a ‘laboratory technician’, but the guarantor of safety and the framework. Pupils make observations according to prepared protocols, record the results and learn to evaluate the difference between a piece of data and a claim.

Note: the links provided are intended for quick verification of basic facts and biographical context.

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OVERVIEW OF MECHANISMS OF UNDERMINING AND DEMOTIVATION – FULL STRUCTURE WITH EXAMPLES

The document is divided into groups and subgroups. Each subgroup includes a concise explanation and a simple example (understandable to a pupil as well).

I. LOGICAL FALLACIES (argumentative manipulation)

Ad hominem

Explanation: Attacking the person instead of addressing what they are claiming.

Example: ‘You are an amateur, so what you are saying is nonsense.’

Genetic fallacy

Explanation: Rejecting an idea solely on the basis of where it comes from.

Example: ‘That comes from the internet/a layperson, so it has no value.’

Argument from authority

Explanation: Something is supposedly true/untrue merely because an authoritative person said so.

Example: ‘The professor said no, so it does not exist.’

Appeal to popularity (bandwagon)

Explanation: Something is supposedly true because many people believe it.

Example: ‘Everyone is laughing, so it must be nonsense.’

Appeal to tradition

Explanation: Something is supposedly right because it has always been done that way.

Example: ‘It has been taught this way for years; there is no point changing it.’

Appeal to novelty

Explanation: Something new is supposedly automatically better or automatically suspicious.

Example: ‘It is new, so I do not trust it.’

Argument from ignorance

Explanation: Something is supposedly true because the opposite has not been proved (or vice versa).

Example: ‘You cannot refute it, so I am right.’

Cherry-picking

Explanation: Selecting only the data that suit one’s case and ignoring the rest.

Example: I show only one bad day of measurements and conceal all the other days.

Straw man

Explanation: Distorting another person’s claim into a weaker version that is easier to attack.

Example: ‘You want to ban everything,’ even though someone only proposed adding a measurement.

False dilemma

Explanation: Pretending that only two options exist.

Example: ‘Either it is perfect, or it is rubbish.’

Moving the goalposts

Explanation: When you meet a condition, another one is added so that it still ‘does not count’.

Example: ‘Fine, you have data, but now I want another 10 tests.’

Whataboutism

Explanation: Diverting attention to another problem instead of answering.

Example: ‘What about other schools? They do not do anything properly either!’

Red herring

Explanation: Deliberately diverting the subject to something irrelevant.

Example: Instead of discussing the results, the discussion focuses on who is funding it.

Hasty generalisation

Explanation: Drawing a general conclusion from a single case.

Example: ‘It failed once, so it never works.’

Circular reasoning

Explanation: The conclusion is ‘proved’ by the very thing that was supposed to be proved.

Example: ‘It is stupid because it is stupid.’

Tu quoque

Explanation: Instead of an argument, someone says: ‘you do it too’.

Example: ‘You make mistakes too, so you cannot say anything.’

Appeal to ridicule

Explanation: Ridicule is used as a substitute for evidence.

Example: Laughter in the classroom instead of an explanation of why the idea is bad.

Appeal to emotion

Explanation: Emotion is used as a substitute for facts (fear, anger, disgust).

Example: ‘That is dangerous!’ without showing why.

Slippery slope

Explanation: It is claimed that one step will automatically lead to disaster.

Example: ‘If we allow this, it will end in complete chaos.’

False equivalence

Explanation: Comparing incomparable things to make them appear equivalent.

Example: ‘That is the same as…’ even though it is a completely different situation.

II. COGNITIVE BIASES (how the brain distorts evaluation)

Semmelweis reflex

Explanation: Automatically rejecting something new merely because it disrupts established habits.

Example: ‘That cannot be done, because it is not done that way.’

Confirmation bias

Explanation: We notice mainly what confirms our opinion.

Example: I notice only comments against the project and ignore neutral ones.

Dunning–Kruger effect

Explanation: Limited knowledge leads to excessive confidence.

Example: Someone with no practical experience claims that they can assess it in 1 minute.

Impostor syndrome

Explanation: A person lacks confidence even though they have results.

Example: ‘I must have got it right only by chance.’

Negativity bias

Explanation: Negative things carry more weight in our minds than positive ones.

Example: One criticism sounds louder than ten compliments.

Status quo bias

Explanation: Preferring the old state merely because it is familiar.

Example: ‘Let us leave it as it is, for the sake of peace.’

Authority bias

Explanation: Overestimating the opinion of an authority figure.

Example: ‘If the boss said it, it must be true.’

Halo effect

Explanation: One good quality ‘colours’ the entire assessment.

Example: ‘He is likeable, so his idea must be good.’

Horn effect

Explanation: One mistake ‘colours’ the entire assessment negatively.

Example: ‘He made a mistake once, so he is incompetent.’

Anchoring

Explanation: The first piece of information establishes the frame, and we then cling to it.

Example: ‘It looked bad at the beginning, so I no longer believe anything else.’

Groupthink

Explanation: The group suppresses other opinions in order to preserve ‘peace’.

Example: Nobody wants to be the first to say that the project is interesting.

Self-serving bias

Explanation: I attribute success to myself and failure to circumstances.

Example: ‘When it worked, it was to my credit; when it did not, it was the fault of the conditions.’

Projection

Explanation: Attributing one’s own motives to others.

Example: ‘You are doing it only for fame,’ without evidence.

Fundamental attribution error

Explanation: Attributing a mistake to a person’s character rather than the situation.

Example: ‘He is lazy,’ instead of ‘he did not have the conditions/time’.

III. PSYCHOLOGICAL DEMOTIVATION TACTICS (what breaks motivation)

Ridicule

Explanation: Mockery reduces the courage to try new things.

Example: ‘Ha ha, did you come up with that?’

Public humiliation

Explanation: Humiliating someone in front of others instead of helping.

Example: A teacher/pupil mocks a mistake in front of the whole class.

Gaslighting

Explanation: Questioning a person’s reality and abilities so that they stop trusting themselves.

Example: ‘You must have seen it wrongly; do not make things up.’

Minimising success

Explanation: Diminishing the value of a result.

Example: ‘That is nothing; anyone could do it.’

Taking away credit

Explanation: Credit is transferred to someone else.

Example: ‘That was not your doing; it just happened.’

Perfectionist paralysis

Explanation: Pressure for perfection prevents a person from starting.

Example: ‘Until it is 100%, do not even show it.’

Comparative devaluation

Explanation: Devaluing something by comparing it with someone ‘greater’.

Example: ‘Universities do it better, so why should you bother?’

Cynicism

Explanation: The attitude that ‘there is no point’ destroys effort.

Example: ‘Nothing will change anyway, so why try?’

Intimidation through failure

Explanation: Creating fear of the consequences.

Example: ‘If you make a mistake, you will look like a fool.’

Criticism without a proposal

Explanation: Merely putting something down without offering specific help.

Example: ‘Bad,’ without explaining what to change.

Labelling

Explanation: Attaching a label reduces willingness to continue.

Example: 'You are always chaotic.'

Double standards

Explanation: Others are allowed to try; you are not.

Example: 'When he does it, it is fine; when you do it, it is a problem.'

IV. SOCIAL AND POWER MECHANISMS (group and hierarchical pressure)

Hierarchical denigration

Explanation: Questioning someone on the basis of status rather than content.

Example: 'You are only a pupil/parent; you do not understand it.'

Authoritarian silencing

Explanation: Ending a discussion without an argument.

Example: 'This is how it will be, and that is final.'

Ostracism

Explanation: Exclusion from the group for being different.

Example: Classmates stop speaking to the person who 'stands out'.

Passive ignoring

Explanation: Saying nothing, merely overlooking something – and thereby killing initiative.

Example: Ideas are systematically 'not heard'.

Gatekeeping

Explanation: Controlling who is allowed to speak/act.

Example: ‘You cannot present it without permission.’

Normalising mediocrity

Explanation: Pressure to ensure that nobody stands out.

Example: ‘Do not try to act clever.’

Punishing difference

Explanation: An idea is met with punishment rather than discussion.

Example: ‘If you keep bothering us with this, you will have a problem.’

Control of resources

Explanation: Withholding time, space or material as a way of stopping something.

Example: ‘We will not give you equipment; you do not need it anyway.’

Reputational pressure

Explanation: Suggesting that a person ‘will look bad’.

Example: ‘People will laugh at you if you publish it.’

Creating camps

Explanation: Dividing people into ‘us’ and ‘them’ in order to destroy objectivity.

Example: ‘Either you are with us or against us.’

V. CULTURAL PATTERNS THAT KILL CREATIVITY

Culture of ridicule

Explanation: Mockery is the usual ‘standard’, so people are afraid to try.

Example: Everyone in the classroom is afraid to voice an idea in case they are laughed at.

Anti-intellectualism

Explanation: Devaluing thought as ‘trying to be clever’.

Example: ‘Do not try to be clever; it is pointless.’

Overvaluing tradition

Explanation: Something new is perceived as an attack on the old.

Example: ‘Why change it when it has always worked?’

Fear of disrupting order

Explanation: Innovation is perceived as a problem.

Example: ‘If we open this up, there will be questions and problems.’

Envy as a regulator

Explanation: Another person’s success triggers attempts to undermine them.

Example: ‘He thinks he is something special.’

‘Do not cause problems’ culture

Explanation: Peace is more important than truth/knowledge.

Example: ‘You had better keep quiet so that we can have some peace.’

Egalitarian levelling-down

Explanation: Everyone must be the same – standing out is punished.

Example: ‘Who do you think you are?’

VI. INSTITUTIONAL BLOCKING STRATEGIES (delay and exhaustion)

Withholding information

Explanation: It is impossible to continue without information.

Example: ‘We will send it…’ and nothing arrives.

Vague criteria

Explanation: A person does not know what is actually required and burns out.

Example: ‘Do it properly’ without defining what ‘properly’ means.

Deferring decisions

Explanation: Decisions are continually postponed so that energy dissipates.

Example: ‘We will see later’ indefinitely.

Administrative obstacles

Explanation: Paperwork replaces the work itself.

Example: ‘Complete another 5 forms, then we will talk.’

Covert discrediting

Explanation: Insinuations are spread without direct discussion.

Example: ‘I have heard that it is not serious…’

Questioning the methodology without analysis

Explanation: Rejection without a specific reason.

Example: ‘The methodology is bad,’ without showing why.

Overloading with parallel tasks

Explanation: You are given additional responsibilities so that you have no time.

Example: ‘Do these things first, then the project.’

Making support conditional on loyalty

Explanation: Help is provided only if you are ‘obedient’.

Example: ‘We will support it if you do not speak about it publicly.’

VII. ECONOMIC AND PRACTICAL DEMOTIVATION MECHANISMS

Underfunding

Explanation: Without resources, a project is gradually worn down.

Example: ‘We do not have the money for it,’ even though the costs are small.

Lack of time

Explanation: Without dedicated time, the project falls apart.

Example: ‘Do it after lessons, if you still have the energy.’

Lack of recognition

Explanation: When the process is not recognised, motivation declines.

Example: Nobody says ‘good work’, even though the protocol was followed.

Constantly changing objectives

Explanation: When the objective changes, people stop believing in its purpose.

Example: ‘Now do something completely different instead.’

Lowering priorities

Explanation: The project is presented as important, but is always placed last.

Example: ‘Everything else first, then this.’

Unreasonable expectations

Explanation: When a miracle is expected immediately, motivation falls.

Example: ‘If it does not produce a result within a week, it is worthless.’

Uncertainty of support

Explanation: If you do not know whether you will be stopped tomorrow, motivation declines.

Example: ‘We may cancel it; we will see.’

VIII. EXTERNAL PSYCHOLOGICAL SABOTAGE (subtle undermining)

Constant questioning without evidence

Explanation: Repeatedly hearing ‘that is rubbish’ drains energy.

Example: Every day someone says, ‘you are making things up again’.

Deliberately inducing doubt

Explanation: A question is phrased so as to make a person lose confidence.

Example: ‘And are you completely sure? Because I am not…’ without an argument.

Twisting words

Explanation: One person says A; another claims they said B.

Example: ‘You claim that it is certain,’ even though what was said was ‘it may be’.

Devaluing the work

Explanation: It is implied that this is not ‘real’ work.

Example: ‘That is just playing around.’

Pressure for speed

Explanation: Pressure is applied to increase the pace so that mistakes are made.

Example: ‘Publish it now, quickly!’

IX. INTERNAL SELF-SABOTAGE (what a person does to themselves)

Procrastination

Explanation: Delaying because of fear or pressure.

Example: ‘I will start tomorrow,’ and then not starting the next day either.

Endless self-revision

Explanation: I keep correcting it and never release it.

Example: ‘It is still not good enough.’

Fear of failure

Explanation: I would rather do nothing than lose.

Example: ‘If I get it wrong, I will look like a fool.’

Fear of success

Explanation: Success will bring attention and pressure.

Example: ‘If it works, they will want more from me.’

Comparing oneself with an ideal

Explanation: I compare myself with the very best right at the beginning.

Example: ‘I am not like them, so there is no point.’

Burnout

Explanation: Prolonged pressure without rest destroys the desire to continue.

Example: ‘I no longer have the energy even to look at it.’

CONCLUSION

Questioning can be useful if it is objective and helps improve the quality of the work. However, if it is used as ridicule, manipulation or the exercise of power, it ceases to be criticism and becomes an obstacle to development.

Recognising these mechanisms helps pupils and adults alike to protect creativity, preserve self-confidence and conduct a civilised discussion – so that ideas are assessed according to their content, not according to a person’s origins.

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Observation Protocol (cover sheet + daily sheets) – notes and examples of completion

This document explains how to complete the Observation Protocol in two parts: (1) COVER SHEET – basic sample information (completed once), (2) DAILY sheets – one day = one page (completed repeatedly). The aim is to learn to distinguish FACTS (observation/measurement) from a HYPOTHESIS (explanation).

1) Notes – COVER SHEET (completed once)

The cover sheet is the sample's 'identity'. Information recorded here does not need to be repeated every day.

A) Fields on the cover sheet

Sample ID (main ID)

What it is: A unique sample code. It is used to link all the daily sheets.

What to enter: The exact code, which must be the same on all subsequent sheets.

Example: BA_VH_2026-02-20_01

Location (description)

What it is: Where the sample was obtained (without evaluation, only a factual description).

What to enter: Town/city or area + a more detailed description (e.g. street, edge of the zone, near a road).

Example: Bratislava – Vlčie hrdlo, edge of the industrial zone, near the main road

Date/time received

What it is: When the school received the sample. The observation period is counted from this point.

What to enter: Date + time (and, optionally, who received it).

Example: 2026-02-20 09:15 (received by class 8.A)

Observer (school/class/team)

What it is: Who conducts the observations and keeps the records.

What to enter: Name of the school (if required) + class + team.

Example: Primary School X, 8.A – team 2

Responsible person (teacher)

What it is: The supervising teacher who oversees the procedure.

What to enter: The name of the teacher or project leader.

Example: Mgr. Nováková

Protocol version

What it is: This makes it clear which version of the form you are using (for comparison between schools).

What to enter: A short version code.

Example: v1

Container/volume (type, material, closure, sample volume)

What it is: A description of the container and how much material is inside.

What to enter: Material (PET/glass), type of closure, nominal container volume and estimated sample volume.

Example: 0,5 l PET bottle, screw cap; sample approx. 350 ml

Baseline storage conditions (temperature, light, closure, location)

What it is: How the sample is stored under normal conditions (baseline conditions).

What to enter: Temperature (approximate), light (dark/daylight/near a window), closure (closed), location (cupboard/classroom).

Example: 22 – 23 °C, daylight (not near a window), closure kept closed at all times, stored in a cupboard

Observation plan (frequency)

What it is: How often you will make an entry (so that the data can be compared).

What to enter: For example: every day at 08:00, or 3× a week – always at the same time.

Example: Every day at 08:10 (before lessons)

B) Rules (cover sheet – purpose)

- The cover sheet is the first sheet. Daily sheets with the same sample ID are attached to it.
- Facts = what I see/measure. Hypothesis = an idea about why this might be the case.
- 'No change' is a valid result – it is recorded as a fact (the condition at a point in time).

2) Notes – DAILY sheet (1 day = 1 page)

The daily sheet is a record of what happened on a particular day. Some things do not change (these are on the cover sheet), so this sheet contains only fields that may change from day to day.

A) Fields on the daily sheet

Sample ID

What it is: This links the daily sheet to the cover sheet.

What to enter: The same code as on the cover sheet.

Example: BA_VH_2026-02-20_01

Day # (sequence)

What it is: The sequential number of the observation day.

What to enter: The day number according to your agreed system (e.g. Day 1 = first entry).

Example: Day 15

Date/time recorded

What it is: When the observation was recorded.

What to enter: Date + time (ideally at approximately the same time each day).

Example: 2026-03-06 08:10

Photo (file name)

What it is: A link to the photo/video so that the observation can be verified.

What to enter: The file name exactly as it is stored.

Example: BA_VH_2026-02-20_01_D15_0810.jpg

Handling (Opened/Unopened/Shaken/Not shaken)

What it is: A quick record of whether the sample was handled.

What to enter: Underline the applicable options and cross out those that do not apply.

Example: Underlined: Unopened + Not shaken

Where the sample was kept (location)

What it is: The storage location on that day (it may change).

What to enter: For example: cupboard, near a window, laboratory, moved to another classroom.

Example: Cupboard in classroom 8.A

Observation – FACTS

What it is: A plain description of what I see (without explaining it).

What to enter: Colour, clarity, sediment, film, shapes, where they are located, change since yesterday.

Example: Pale yellow, translucent; fine sediment ~1 – 2 mm at the bottom; no film on the surface; no visible clusters.

Measurements – FACTS (if taken)

What it is: Numerical values (if you have instruments).

What to enter: Value + unit. If you do not measure anything, leave blank.

Example: T = 22,4 °C; pH 6,8; TDS 145 ppm

Hypothesis

What it is: An idea about why this might be happening (not a claim).

What to enter: Use conditional phrasing: ‘could be’, ‘may mean’.

Example: The sediment may consist of insoluble particles captured from the air; there is no evidence yet.

What to observe next / next step

What it is: A plan for the next observation.

What to enter: For example: what to photograph, what to look for, whether not to stir/expose to light/move it.

Example: Photograph from the same angle tomorrow; observe whether the sediment increases; do not stir for 48 h.

B) Brief rules (for children)

- A FACT is something I can show in a photograph or with a number.
- A HYPOTHESIS is only an idea – it may be right or wrong.
- ‘No change’ is also information: it means that the sample was stable at that time.
- Always record handling (opening/shaking), because it may change the result.

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3) Example of a completed COVER SHEET (model)

A model example using fictitious information (your ID, location and conditions will be different).

Sample ID (main ID)

Location (description)

Date/time received

BA_VH_2026-02-20_01

Bratislava – Vlčie hrdlo, edge of the industrial zone, near the main road

2026-02-20 09:15

Observer
(school/class/team)

Responsible person (teacher)

Protocol version

Primary School X, 8.A – team 2

Mgr. Nováková

v1

Container/volume (type, material, closure, sample volume)

Baseline storage conditions (temperature, light, closure, location)

0,5 l PET bottle, screw cap; sample approx. 350 ml

22 – 23 °C, daylight (not near a window), closure kept closed at all times, stored in a cupboard

Observation plan: every day at 08:10 (before lessons)

Rules: FACTS = observation/measurement. HYPOTHESIS = explanation (conditional).

Note: ‘No change’ is a valid result (the condition at a point in time).

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4) Example of a completed DAILY SHEET (model)

Model daily record (1 day = 1 page).

Sample ID

BA_VH_2026-02-20_01

Day # (sequence)

Day 15

Date/time recorded

2026-03-06 08:10

Photo (file name)

BA_VH_2026-02-20_01_D15_0810.jpg

Handling (underline the applicable options and cross out those that do not apply): Opened / Unopened / Shaken / Not shaken

Underlined: Unopened + Not shaken

Where the sample was kept (location)

Cupboard in classroom 8.A

Observation – FACTS:

Pale yellow, translucent; fine sediment ~1 – 2 mm at the bottom; no film on the surface; no visible clusters.

Measurements – FACTS:

T = 22,4 °C; pH 6,8; TDS 145 ppm

Hypothesis:

The sediment may consist of insoluble particles captured from the air; there is no evidence yet.

What to observe next / next step:

Photograph from the same angle tomorrow; observe whether the sediment increases; do not stir for 48 h.

Note: Record ‘no change’ as a FACT too (the condition at a point in time).

Observation Protocol – COVER SHEET

(basic information)

Sample ID (main ID) Location (description) Date/time received

Observer (school/class/team) Responsible person (teacher) Protocol version

Container/volume (type, material, closure, sample volume) Baseline storage conditions (T, light, closure, location)

Observation plan (e.g. every day at the same time / frequency)

Notes: ‘No change’ is a valid result (the condition at a point in time).

Use: This cover sheet comes first. All subsequent daily sheets carry the same sample ID and the day sequence number.

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Annex to the Protocol – OBSERVATION QUALITY-CONTROL SHEET (1 page)

Purpose: to make daily records comparable between classes and to separate FACT from assumption.

Sample ID Day #

Date/time Team name

B) Contamination and handling (so that we know whether we may have affected anything)

☐ It is clear whether the sample was opened or unopened.

☐ It is clear whether the sample was shaken or not shaken.

☐ Its storage location is stated (classroom/window/dark/cold).

☐ If an accidental event occurred (spillage, contact, fall), it is recorded.

C) Separation of FACT from assumption (to prevent bias)

☐ The FACTS section contains only what I see/measure (colour, shape, film, sediment, numbers).

☐ The hypothesis is written as ‘may be’ (not as a certainty).

☐ If I do not know something, it is recorded as ‘do not know / unclear’, not made up.

☐ If AI was used, the question and answer are in the AI Protocol and are paired with this day.

Note (what is different from usual today / what may distort the result):

Signature: ________________________________ (pupil/team) ________________________________ (teacher/supervisor)

A) Comparability of the record (so that it can be compared between schools)

☐ The photograph is always taken from a similar distance and angle (if not, this is recorded in the note).

☐ The photograph includes a scale/reference to scale (ruler, grid, or at least the same container) – if not, this is stated.

☐ The lighting is similar (daylight/artificial) – if it has changed, this is stated.

☐ The date/time is recorded and corresponds to the day sequence.

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Notes on the ‘Observation Quality-Control Sheet’

This quality-control sheet is not ‘more bureaucracy’. It is a simple aid that ensures your daily records retain their value after a week, after a month and, most importantly, that they can be compared with another class or school.

Why this is important:

- If the angle of the photograph, the lighting or the distance changes, things may look different even though the sample has not changed.
- If the sample is opened or shaken even once, this may change the sediment, film or distribution of particles.
- If we imagine a cause (an assumption) and record it as a fact, the next day we already ‘see’ what we expect – this is a common bias.
- For a result to be credible, it must be clear what is an observation (fact) and what is an explanation (hypothesis).

How the sheet is used in practice:

1. At the end of each daily record, the team reviews the quality-control sheet and ticks the items it has completed that day.
2. If something does not match (e.g. different lighting, a different photograph angle, accidental spillage), nothing is ‘hidden’ – it is simply recorded in the note.
3. If AI was used, pairing is important: the same sample ID + the same Day # + the AI Consultation Sheet.
4. The teacher does not need to invent anything: they only check that the minimum information has been completed (time, photograph, factual observation and a note if anything is different).

What this sheet protects:

It protects the project from turning into a ‘story’. The scientific approach is simple: I make an observation, record it and only then look for an explanation. When a record is clear, a great deal can be learnt from it later – even if we do not yet know what it means today.

A brief, plain-language example:

If I take a photograph near a window today and under a lamp tomorrow, the colour may look different. Without a note, someone might think the sample had changed. The quality-control sheet reminds us that ‘the lighting changed’ – and we immediately know that this may distort the comparison.

Conclusion:

The quality-control sheet is a small additional step that significantly improves the quality of the entire project. It is the simplest way to maintain a fair comparison between days and between schools.

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Observation Protocol – DAILY SHEET (1 day = 1 page)

This follows on from the COVER SHEET (the sample ID + basic information are recorded there).

Sample ID Day # (sequence)

Date/time recorded Photo (file name)

Handling (underline the applicable options and cross out those that do not apply):

Opened / Unopened / Shaken / Not shaken

Where the sample was kept (location)

Observation – FACTS (what I see): colour, clarity, sediment, film, shapes, where they are located

Measurements – FACTS (if taken): values + units (e.g. T, pH, TDS, conductivity)

Hypothesis (only a proposed explanation; do not present it as fact)

What to observe next / next step (plan)

Note: AI ‘no change’ – describe it as a FACT (what you see), not as a story.

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ANNEX: Configuring artificial intelligence for work in the air-extract observation project (primary schools)

Practical guide for schools and classes • version 23.02.2026

1. Purpose of the document

This annex describes how to use artificial intelligence (AI) in the project so that it assists with data, photographs and texts, without its outputs automatically being regarded as ‘truth’. The document is intended for primary schools and follows on from the project’s core document and previous annexes.

2. Basic principle: AI is a tool, not an authority

- AI can accelerate calculations, summaries, comparisons and the formal processing of source material.
- AI can make mistakes: it may invent details that are not in the data or confuse cause and effect.
- AI has no direct access to reality: it works only with what we give it (text, numbers, photographs).
- AI outputs are therefore always treated as a hypothesis or a proposed interpretation, not as evidence.

3. Why calculations should be performed in Python

To ensure that results are comparable between schools, calculations should be performed in Python. The same code and the same input data must produce the same result. This reduces the risk of different classes obtaining different numbers merely because they phrased the question differently.

- The following must be saved for every calculation: (a) input data, (b) Python code, (c) result, (d) date and author.
- If AI proposes a calculation, it must also provide the Python code (to be copied into the shared template).
- A calculation is not considered verified without the code.

4. Working with photographs: what AI can and cannot do

4.1 What AI can do

- Describe visible features: shapes, colours, layers, marks, cracks, clusters and signs of drying.
- Assist with a systematic approach: suggest which properties to observe and how to record them in a table.
- Compare two photographs, ‘A vs B’, in the same way (using the same comparison points).
- Prepare a written summary of the observation from the pupils’ notes.

4.2 What AI cannot do without evidence

- Determine the precise composition of substances from a photograph alone.
- Declare that something is a ‘bacterium’, ‘mould’, ‘polymer’ or ‘salt’ without evidence.
- Confirm a cause (e.g. ‘it formed because of X’) without measurement or control of the conditions.

5. AI and chemical interpretations (e.g. polymerisation)

For chemical topics (e.g. polymerisation, oxidation, precipitation, crystallisation, gel formation), a strict distinction must be made between: (1) what we see, (2) what we measure, and (3) what we merely assume. AI may suggest possible mechanisms, but the class must label them as hypotheses and identify what would need to be measured to confirm or refute them.

6. Practical example: ‘CO is captured’ vs ‘CO is not captured’

The project may encounter a situation in which a person and AI appear to be on a ‘collision course’, but each is actually addressing a different part of the statement.

- Statement A (observation): CO in the output decreased – this is a measurable result (e.g. in Protocol 307).
- Statement B (caution): CO is not physically ‘captured in steam’ like a sponge – this is a valid objection.
- Compatible explanation: CO may decrease not because it has been ‘captured’, but because it changed during the process (conversion/oxidation) into another substance. The decrease in CO is then real, but the mechanism is transformation rather than capture.

Lesson: data first, then interpretation. The interpretation is presented together with the degree of certainty.

7. How to ask AI questions (standard for schools)

7.1 Basic prompt format

1. State exactly what you need (calculation / comparison / description of photographs / logic check).
2. Provide the inputs (numbers, table, notes, photographs) and label them clearly (Sample A, Sample B, Day 1, Day 7...).
3. State the units and conditions (time, temperature, sampling location, volume).
4. Request an output structured as follows: (a) what is certain, (b) what is uncertain, (c) possible explanations (as hypotheses only).
5. For calculations, always ask: ‘Provide the Python code that performs the calculation.’

7.2 Examples of questions (templates)

- ‘Calculate the percentage change from these data and provide the Python code.’
- ‘Compare these two photographs using visible features only (colour, shape, layers) and do not make any assumptions about composition.’

- ‘Summarise these notes in an observation protocol (timeline, what changed, what remained the same).’
- ‘Suggest 3 possible explanations for what we see, but label them as hypotheses and, for each one, state which measurement would verify it.’

8. Publishing outputs: what it is scientifically correct to claim

When publishing (school website, noticeboard, video, presentation), three layers of communication are distinguished:

- Observation: ‘We see…’, ‘We recorded…’, ‘The photograph shows…’.
- Measurement/calculation: ‘We measured…’, ‘We calculated… (the Python code has been saved)…’.
- Interpretation: ‘This may be related to…’ (always as a hypothesis, not as a certainty).

AI is identified as an auxiliary tool: ‘The text and calculations were processed with the assistance of AI; the results were verified by the class against the saved data and code.’

9. Why AI outputs may differ between schools

If different schools or classes configure AI differently (different prompts, different rules, a different style of questioning), the outputs may also differ: vocabulary, emphasis, the order of arguments and sometimes even interpretations.

- A common ‘standard prompt’ and a common output structure are used to ensure comparability.
- Key results must be linked to data and Python code, not to AI’s wording.
- A person (the pupil) is irreplaceable in observing details, being patient and being able to say: ‘We do not know this yet.’

10. Minimum standard (checklist)

- Every observation includes the date, time, sample identifier and author (class/group).
- Every photograph follows a standard file-naming convention (school_class_sample_dayX_date).
- The Python code for every calculation is saved together with the result.
- AI texts do not contain claims about composition when there is no evidence for them.
- Publications strictly distinguish observation from interpretation.

AI Protocol – CONSULTATION SHEET (1 consultation)

Pairing with the pupil's DAILY SHEET: the same sample ID + the same Day #.

Sample ID Day # (sequence)

Date/time of consultation Pupil's sheet

(page/sequence)

Photo (file name) AI tool / version

INPUTS for AI (what we gave it):

- brief description of observations from the pupil's sheet (FACTS)
- measurements (if any) + units
- photographs: file names
- what was opened/shaken, etc. (if relevant)

QUESTION for AI (prompt – copy exactly):

1/2

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AI RESPONSE (copy/provide without changes):

PAIRING with pupils' records (matches): DIFFERENCES / what AI claims in addition (beware of assumptions):

WHAT WE WILL VERIFY NEXT (test/observation plan: who and when):

Name/signature (pupil/team) Name/signature (teacher/supervisor)

Note: AI may be accurate or mistaken. Evidence is limited to what is in the observation/measurement and what can be repeated.

2/2

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Media/Report Log – version 5: notes + completed example (1 document)

1) Notes (how to complete it)

This sheet is used to record ONE media or interim output relating to one sample. The aim is to make it possible to demonstrate retrospectively who produced it, when, which source material they used (photographs/videos), exactly what they wrote, and whether it consisted of facts or merely an idea (hypothesis).

A) Top header (sample information)

Sample ID

What it is: A unique code that prevents the sample from being confused with another.

What to enter: An exact transcription of the code from the sample or the Observation Protocol.

Example: BA_VH_2026-02-20_01

Class/team

What it is: Who is working on it (so that the author is clear).

What to enter: Class + team designation (e.g. team 1, team 2…).

Example: 8.A – team 2

Period (from – to)

What it is: The period covered by this output (or the period during which the data were collected).

What to enter: The start and end dates of the period summarised by the output.

Example: 2026-02-20 – 2026-03-20

Responsible person (teacher)

What it is: The supervising teacher (the person overseeing the process and publication).

What to enter: The name of the teacher or person responsible for the project at the school.

Example: Mgr. Nováková

B) Middle section (output information)

Record #

What it is: The sequential number of this output for one sample.

What to enter: A simple number (MR-01, MR-02...).

Example: MR-01

Date/time created

What it is: When the output was created (prepared).

What to enter: Date and time (e.g. after lessons).

Example: 2026-03-06 18:40

Author (initials/team)

What it is: Who actually wrote or edited it (not just the class).

What to enter: Initials or name + team.

Example: MK (team 2)

Type of output

What it is: The form in which the output was produced (format).

What to enter: For example: FB Story, post, Reels, school report, classroom presentation.

Example: FB Story (interim report)

Platform/location

What it is: Where it appeared (or where it was used).

What to enter: Platform name + section (Stories/Reels/post) or ‘in the classroom’.

Example: Facebook – Stories

Observation segment (days)

What it is: Which days of the observation are summarised in this output.

What to enter: One day or a range (D10–D15).

Example: Days 10–15

Classification: Facts / Hypothesis / Both (underline the applicable option and cross out those that do not apply)

What it is: This helps the reader see immediately whether the output is only a description of reality (facts) or also includes an explanation (hypothesis).

What to enter: Underline the option that is true for your output. Cross out the other options.

Example: Underlined: Both (Facts and Hypothesis)

Approved by (optional)

What it is: Who approved the output if it is being published outside the school.

What to enter: Name of the teacher/supervisor (if approval was required). Otherwise, this may remain blank.

Example: Mgr. Nováková

Link/ID (link or screenshot)

What it is: How the output can be found later. If the link does not work, take a screenshot as evidence.

What to enter: Either insert the link or enter the name of the screenshot/file where it is stored.

Example: Screenshot: MR-01.png (folder …/media/)

C) Lower section (large fields – most of the writing goes here)

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Source materials used (exact file names, Day # from the Observation Protocol)

What it is: A complete list of evidence so that it can be verified that the text matches the photographs/video.

What to enter: List all files (photographs/videos) and assign a Day # to each.

Example: BA_VH_..._D15_0810.jpg (Day 15); BA_VH_..._D15_detail.mp4 (Day 15)

Output text (inserted wording) – FACTS / HYPOTHESIS

What it is: Copy here the exact text that you published. FACTS are limited to what you actually see or have measured. A HYPOTHESIS is an idea about why this might be the case.

What to enter: Write the FACTS (description) first, followed by the HYPOTHESIS (possible reason). If you have only facts, leave the hypothesis blank.

Example: FACTS: Day 15 – the sample is stable, with no visible change.

HYPOTHESIS: The stability may mean that no visible aggregation is taking place yet.

Note / changes / reactions / corrections

What it is: Additions belong here: what changed after publication, questions from people, corrections to the text, the reason for withdrawal, etc.

What to enter: Briefly and factually. If nothing happened, this may remain blank.

Example: Reactions: 6 questions in the comments – answered factually.

D) Rules (brief and clear)

- Observation/measurement = FACTS. Explanations belong in the HYPOTHESIS.
- If the text also includes a hypothesis, it must be clearly separated from the facts (blocks labelled ‘FACTS:’ and ‘HYPOTHESIS:’).
- ‘No change’ is a valid result – it is the condition at the given time, not ‘nothing’.
- Source materials must be traceable (file names, Day #, link or screenshot).

2) Example of completion (model record)

This is only a model. In practice, replace the ID, days, files and text with your own.

Sample ID Class/team Period (from – to) Responsible person

(teacher)

BA_VH_2026-02-20_01 8.A – team 2 2026-02-20 –

2026-03-20

Mgr. Nováková

Record # MR-01 Date/time created 2026-03-06 18:40

Author (initials/team) MK (team 2) Type of output FB Story (interim report)

Platform/location Facebook – Stories Observation segment (days) Days 10–15

Classification:

Facts / Hypothesis /

Both

(underline the applicable option and cross out those that do not apply)

Underlined: Both

Approved by (optional):

Mgr. Nováková

Link/ID (link or screenshot)

Screenshot: MR-01.png

(folder .../media/) Source materials used

(brief list)

BA_VH_..._D15_0810.jpg;

BA_VH_..._D15_detail.mp4;

Day 15

Source materials used (exact file names, Day # from the Observation Protocol)

- BA_VH_2026-02-20_01_D15_0810.jpg (Day 15)
- BA_VH_2026-02-20_01_D15_detail.mp4 (Day 15)

Output text (inserted wording)

FACTS:

Day 15 – the sample is stable, with no visible change. The colour is pale yellow, with no film on the surface. The container was stored in a cupboard at 22–23 °C, and the closure was kept closed at all times.

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HYPOTHESIS:

The stability may mean that no visible aggregation is taking place under these conditions yet, or that the changes are still too small to be visible to the naked eye. We will continue observing for another week.

Note / changes / reactions / corrections

Reactions: 6 questions in the comments – answered factually. Unopened and not shaken during the D10–D15 period.

Rule: FACTS are what I see/measure. A HYPOTHESIS is only an idea. ‘No change’ is also a result.

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Media/Report Log – record sheet (1 record)

Sample ID Class/team Period (from – to) Responsible person
(teacher)

Record # Date/time created
Author (initials/team) Type of output
Platform/location Observation segment (days)
Classification:
Facts / Hypothesis /
Both

(underline the applicable option and cross out those that do not apply)
Approved by (optional):

Link/ID (link or screenshot)
Source materials used
(brief list)

Source materials used (exact file names, Day # from the Observation Protocol)

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Output text (inserted wording)

FACTS:

HYPOTHESIS:

Note / changes / reactions / corrections

Rules for record reliability

- Observation/measurement = FACTS. Explanations belong in the HYPOTHESIS.
- If the output also contains a hypothesis, it must be clearly separated from the facts in the text (blocks labelled ‘FACTS:’ and ‘HYPOTHESIS:’).
- ‘No change’ is a valid result – it is recorded as a fact (the condition at the given time).
- The source materials used must be traceable (file names, Day # and, where applicable, a screenshot).

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Notes (for pupils in Year 7 and above): abbreviations and technical terms

Aim: To ensure that all pupils understand the project from the outset, we explain the abbreviations and terms that we will encounter in the project. Some terms go beyond the usual curriculum – that is precisely why we explain them simply and with examples, so that you understand them and can use them correctly in the protocols.

How to use this section: When an abbreviation or term that you do not know appears in the protocol, look it up here and then use it precisely in your entry (as a fact, question or hypothesis).

A) Abbreviations – what they mean (in simple terms)

Abbreviation Explanation for the pupil Example

IIIT® The name of the project. It identifies what we are doing – observing samples and learning to work scientifically.

‘IIIT® project’ = our school project.

AI Artificial intelligence. It is a program that can answer questions. We do not regard it as ‘truth’; it is an assistant.

AI can suggest explanations, but we must verify them through observation.

ID A short designation for a sample or record, so that nothing is confused.

ID: VZ01 (sample 1).

TDS A value from an instrument that measures how much ‘dissolved material’ is in water (a number in ppm).

TDS 145 ppm (I record it as a measurement fact).

pH A number indicating whether a solution is more acidic or alkaline.

pH 6,8 (a measurement fact).

FB Facebook – an example of a place where a media output can be created (post, Story, Reels).

‘Platform: FB’ in the Media/Report Log.

GDPR Rules on how to protect personal data (names, faces, contact details).

When we publish an output, we take care with people’s names and photographs.

BOZP Health and safety rules. At school, this means working in a way that ensures no one is injured and nothing is damaged.

We follow the teacher’s instructions and handle the sample safely.

ŠVP The State Educational Programme – the framework for what should be taught at school.

The project can be incorporated into topics and skills from the ŠVP.

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SEM/EDS The name of a laboratory method (electron microscope + elemental composition). We do not use it every day at school, but it is an ‘example’ of how a sample can be analysed in a laboratory.

An explanation that very precise methods are also available when needed.

CO A gas (carbon monoxide). It is mentioned in the text as an example of gas measurement.

It is not the same as CO_2.

Protocol 307 A designation for one type of measurement/protocol mentioned in the text as technical support.

In the text: ‘according to Protocol 307’.

B) Terms – how to understand them in our project

Term Explanation for the pupil How to record it

Fact (observation) Something I actually see or measure. A fact does not say ‘why’; it only says ‘what is’.

‘The colour is yellow.’ ‘TDS is 145 ppm.’

Hypothesis An idea about why something is happening. A hypothesis is a question/estimate that can be tested.

‘Could this be sediment from dust?’

Assumption A quick impression or guess without evidence. In the protocol, it is better written as a question or hypothesis, not as a fact.

Instead of ‘it is mould’, write ‘could it be…?’.

Interpretation A summary of what the facts may mean. This is done only after the factual entries.

Facts first, then interpretation.

Contamination When something from outside enters the sample (dust, contact, other water). This may change the result.

When we open the container, we record it.

Standardisation We do things in the same way so that results can be compared between teams and schools.

The same container, the same method of taking photographs, the same observation time.

Quality control We check whether we measured and recorded honestly and comparably.

A scale in the photograph, units for measurements.

Reproducibility Another team can do the same thing and obtain a comparable result.

When the procedure is clear and recorded.

Traceability of attachments To find a photograph/PDF later, the protocol must include its name and storage location.

‘PDF: VZ01_Zi05_AI.pdf | Storage location: …’

Methodological supervisor The teacher responsible for the rules, safety and correct procedure.

The supervisor confirms the protocols.

Digital attachment A computer file (PDF, photograph, video).

I provide the name and storage location.

Printed attachment A PDF that has been printed and placed in the file.

In the protocol, I write ‘PDF attached’.

Note: If you do not understand something, ask the teacher. It is perfectly acceptable not to know something in this project – what matters is knowing how to look it up and record it correctly.

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Reference samples: your own comparison waters

In addition to the samples supplied, the class may also prepare its own reference (comparison) water samples. They are used to compare observations and measurements made using the same procedure.

Sources of reference samples

- tap water,
- distilled or demineralised water,
- water from a stream or river,
- rainwater (collected in a clean container).

How they are recorded

The same forms and record-keeping method used in the project are used for reference samples (cover sheet + daily sheets + any supplementary records).

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Internal school archiving: labels, registration and traceability of attachments

This page is intended for inclusion in the project documentation (both printed and digital).

Basic principle

The archiving of digital attachments (PDFs, photographs, video) is an internal matter for the school. The school determines its own storage and record-keeping system and may modify it over time as required.

Labels and registration system

The school or pupils determine the labels used for registration (e.g. sample ID, folder names, class designation, observation day) so that the system is practical and understandable for them.

What is mandatory for traceability

Every protocol must contain a trace that makes it possible to find the attachment later without doubt: the file name and exact storage location (or information that the PDF is attached in printed form).

Entry in the 'Note' field (briefly – 1 line)

- Digital attachment: PDF: <file_name.pdf> | Storage location: <folder/location>
- Printed attachment: PDF attached: <file_name.pdf>

Responsibility

The methodological supervisor/teacher, or a person appointed by them in accordance with the school's internal rules, is responsible for archiving and managing attachments.

Purpose

The aim is to ensure that the school can use the protocols at any time to determine where attachments are located and can find, present or add them to the project documentation.

Methodological supervisor / responsible person (name, signature): ______________________________

Date: ______________________

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Adriana Voroničová - IIIT®

Based on publicly available registers, we provide the business identification details of the entity 'Adriana Voroničová - IIIT®' for the purposes of the project documentation.

1) Identification of the entity

Business name: Adriana Voroničová - IIIT®

Business ID (IČO): 40009645

Tax ID (DIČ): 1026936680

VAT ID (IČ DPH): No

Date established: 15. 07. 1997

Place of business: 07253 Bežovce 256

Register / authority: Michalovce District Office

Trade Register number: 807-9181

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