



Funded by  
the European Union

# Promoting ACTIVE and Responsible Citizenship in Schools



## Toolkit

### *I. Methodology for teachers*

#### MODULE 4 Making sense of information

Give the information a meaning – conclusions based on evidence and understanding



Sukromna základna  
škola  
Felix



**WSB University**



Funded by  
the European Union



*The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.*



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

**Attributed to:**

Developed under the project ACTIVE financed by Erasmus+ program

Organization responsible for development of the material: Odpovědná společnost, z. s.

Authors: Mareš, Matěj & col.

In collaboration with project partners

Version 1.1

May 2023

## Content

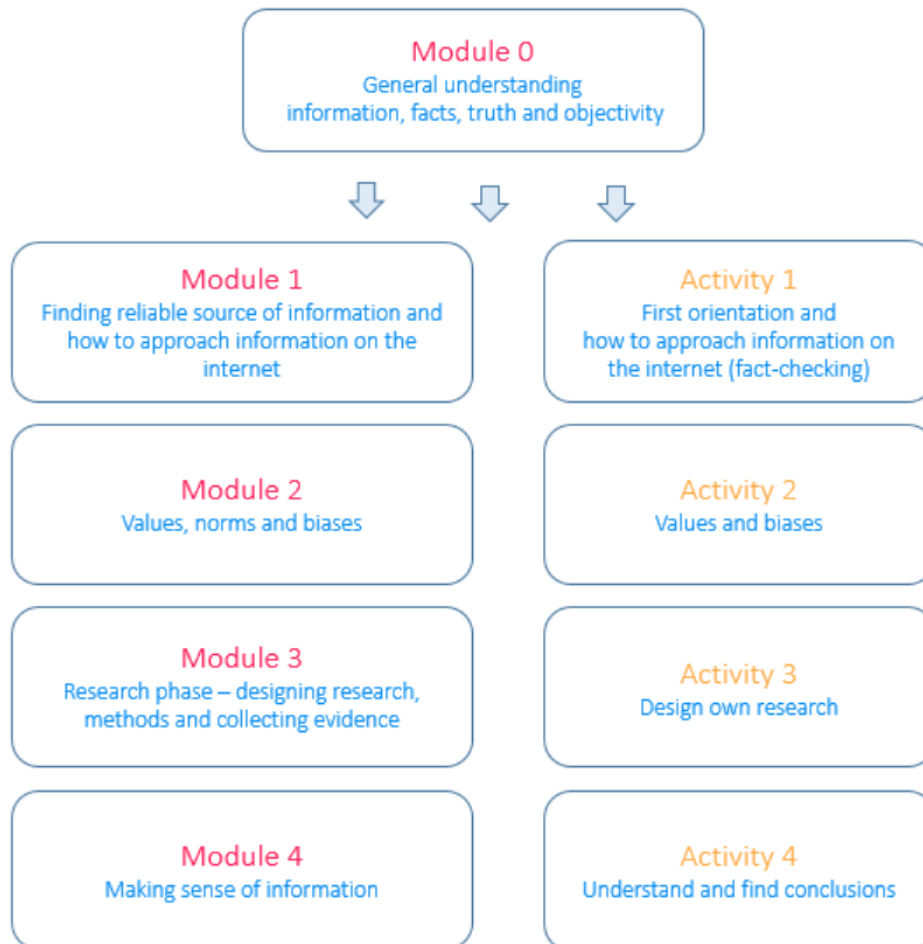
|  |    |
|--|----|
| Content .....  | 2  |
| <i>Module and Activity overview</i> .....  | 3  |
| MODULE 4: Making sense of information.....                                       | 4  |
| 4.1. Making sense of information .....   | 4  |
| 4.2. Steps how to get to the relevant understanding of the concerned issue ..... | 6  |
| 4.3. Practical tools when making sense of information .....                      | 7  |
| 4.3.1. How to analyze data and information .....                                 | 7  |
| 4.3.2. How to assess relevance of evidence .....                                 | 9  |
| 4.3.3. How to come to conclusions .....  | 12 |
| 4.4. Basic principles when making sense of information .....                     | 13 |
| 4.5. Conspiracy theories and bad practices .....                                 | 14 |
| 4.6. Beyond data and information – knowledge and wisdom.....                     | 15 |



Funded by  
the European Union

*Module and Activity overview*

**Modules & Activities**











## MODULE 4: Making sense of information

“DATA AND INFORMATION HAVE NO MEANING BY IT SELF,  
WE ARE THE ONE THAT ARE GIVING THE INFORMATION A MEANING.”

Structure of the module:

Topics covered:

-  Making sense of information
-  Relevant understanding of the concerned issue
-  Analyze data and information
-  Interpretation of data and assess relevance of evidence
-  The main aspects of conspiracy theories
-  Beyond data and information – knowledge and wisdom

Main topics of the module:

In this module we will explore following topics:

*How to make sense of information?*

*How to get from data and information to knowledge and wisdom?*

*How to minimize the danger of conspiracy theories and disinformation?*

*How should we judge competing explanatory claims?*

*How can we make decision about which alternative explanations are more convincing?*

*How to establish causation and confirm or eliminate a hypothesis?*

### 4.1. Making sense of information

“IN THE WORLD OF ABUNDANCE OF INFORMATION AND LIMITED ATTENTION IT IS  
COMPLICATED NOT TO LOSE OUR SELVES AND THE TRUE MEANING OF THINGS.”

*„We have more information now than we can use, and less knowledge and understanding than we need. Indeed, we seem to collect information because we have the ability to do so, but we are so busy collecting it that we haven't devised a means of using it. The true measure of any society is not what it knows but what it does with what it knows.“<sup>1</sup>*

We have already pointed out in Module 0 that collecting and gathering information (see Module 1 & 3) is important but only as the first step in responsible decision making supported by evidence. The goal should be **relevant understanding of the issue we are dealing with**.

In this sense we strive for **coherent explanation** that considers all the relevant aspects and taking in account the available **evidence** and **knowledge** when considering also the **unknowns**.

To make it more approachable we can think of sense making also as a **way of formulating relevant arguments supported by evidence** (or explanation).

---

<sup>1</sup> Warren Bennis American leadership expert 1925 - 2014 Warren G. Bennis (1990) Why leaders can't lead: the unconscious conspiracy continues. p. 143 1990s



**SUMMARY) Take into the class** The Module 4 integrates and utilizes the activities and knowledge from the previous Modules and the outcome should be relevant understanding of the concerned issue that allows us to formulate relevant explanations and arguments based on adequate evidence and understanding the viewpoints of relevant actors. To summarize **the goals to achieve** in this Module to take into the class:

- ✚ Have **relevant understanding of the concerned issue** based on:
  - Evidence supported by reliable and relevant data and information
    - Be aware of quality of data (see Module 1)
    - Be aware of disinformation, fake-news and misinformation (see Module 1)
    - Collected data and information from secondary or primary sources by your own research (see Module 3)
  - Considering and taking into account **all the relevant/important aspects of the issue**
    - Be aware of manipulative techniques (see Module 2)
    - Be aware of the biases (yours in the first place) (see Module 2)
    - Be aware of the perceptions and points of view of relevant actors (see Module 2)
    - Be aware of the framing of the issue by relevant actors and their arguments (see Module 2)
  - Assessment and **weighting the evidence available**
    - Interpretation of the findings from the research phase (Module 4)
    - Understand the evidence available (Module 4)
    - Formulating coherent explanation and arguments supported by evidence (Module 4)
    - Understanding the unknowns (Module 4)

**IMPORTANT** Remember that we aim to go beyond fact-checking and formulating isolated arguments. The overall aim should be to have broader understanding that intercorporate all the necessary aspects of the concerned issue relevant for our decision making (to take action, formulate arguments or explanation).



## 4.2. Steps how to get to the relevant understanding of the concerned issue

The Module 4 integrates and utilizes the activities and knowledge from the previous Modules. As such the Module 4 could be used for comprehensive set up of the research in the pursuit of finding relevant explanations and arguments.

**SUMMARY) Take into the class** The concrete steps in pursuit of relevant understanding of the concerned issue should be best organized in the following steps and questions to be answered on the way:

### I. First orientation - understand the scope of the concerned issue (closely connected to Module 2)

#### *Pre-research phase*

- ✓ What is known about the issue?
- ✓ What concerns us? What is the issue about (topic, scope)?
- ✓ What are the relevant aspects of the issue that should not be missed?
- ✓ What are the relevant actors and their points of view?
- ✓ What biases are concerned?
- ✓ What are the arguments/data/information available?
  - see Module 2 about how to explore and understand points of view of relevant actors

### II. Formulating the problem, hypothesis and criteria (closely connected to Module 3)

#### *Prepare for the research phase*

- ✓ Understand the goal of your pursuit. What are you looking for - the problem to be solved? (finding solution, be able to explain something, understand impact)
- ✓ Two different goals of the research depending on whether you can already formulate theory/hypothesis (how things seem to be) or you have to explore the issue at first:
  - i. Formulate a hypothesis based on existing explanations of the issue (can be based on your perception or perception/arguments of others)
  - ii. Define what we should explore and know about the issue to better understand it
- ✓ Design the research: Formulate criteria (evidence) that is needed to dismiss or prove the hypothesis or that you need to collect to have better understanding of the issue
  - see Module 3 about how to design own research

### III. The research phase (closely connected to Module 1 and 3)

#### *The research phase*

- ✓ Collect relevant, reliable and complete evidence (data and information)
  - see Module 1 about required quality of data
  - see Module 3 about how to conduct research
  - see Module 1 about how to collect reliable information on the internet

### IV. Formulate conclusions based on findings from research and assessing the evidence (closely connected to Module 4)

#### *Interpretation of data and information collected in research phase*

- ✓ Analyze qualitative and quantitative findings (data) from the research
- ✓ Assess the evidence using the tests
- ✓ Formulate conclusions – decisions to be made (and understand unknowns)
  - see Module 4 (below) about qualitative and quantitative analysis
  - see Module 4 (below) how to test evidence and formulate conclusions



## 4.3. Practical tools when making sense of information

### 4.3.1. How to analyze data and information

After we have collected the data through the research phase<sup>2</sup> (see Module 3) we have to analyze them to be able to come to **relevant findings and conclusions**. To learn how to properly analyze data using sophisticated statistical methods will be more a university level. But this should not “scare” us or stop us from do it with primary or secondary school students. Even quite simple methods can give us quite reliable outcomes.

At first and importantly we have to **understand the difference between quantitative and qualitative data** (see also the Module 3):

#### Quantitative data:

- presented as number and referring to measurement: How many, How much, How often
- anything that can be counted or we can set an intervals showing difference (like three times larger than something else)
- mathematical and statistical operations can be used – analyzed by statistical analysis
- gathered from statistics or by representative questionnaires or observations

#### Qualitative data:

- description referring to “why” or “how” (what is behind certain behavior – intentions, feelings, motivation, or explanation how something works or describing properties)
- gathered by interviews or from texts, videos, recordings

**IMPORTANT** Be careful not to forget that quite similar information can become qualitative and quantitative – see the example below.

**EXAMPLE** We have done an interview with all 10 students in the class about how they feel. Based on the interview we could understand the qualitative aspects about how they feel and why. Bu we can also quantify the findings as for example that half of the students (five out of ten or 50 %) felt “bad” today (by their own subjective assessment) or that the reason for students to feel “bad” was due to, receiving low score from the exam (4 out of 5 students) and problems in relationships with other students (1 out of 5).

#### *Analyze quantitative data using descriptive statistics*

To analyze quantitative data we recommend to use simple methods of **descriptive statistics** as: **percentage (%)**, **means**, **median**, **kvantiles**. As such all the analyses can be done in MS Excel.

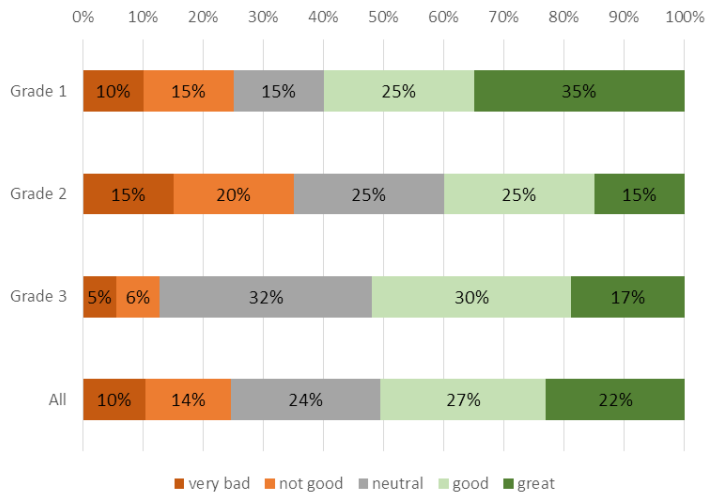
**RECOMENDATION:** *If you are not a math teacher, we would recommend you to collaborate with a math teacher. This will be very good opportunity to show students how to apply methods from one field (math and statistics) to other field (biology, geography, history etc.).*

---

<sup>2</sup> Someone could well point out that analysis is also part of the research and we would agree.

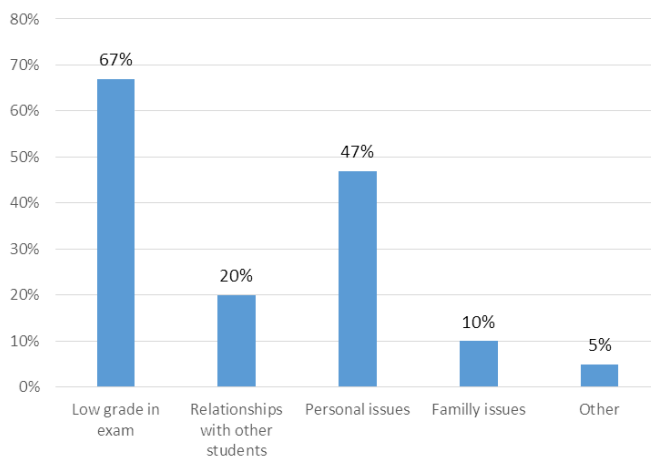


**EXAMPLE** Graf example showing percentage of students from different grades: *How do you feel today in the school?*



Source: Our own school survey

**EXAMPLE** Graf example showing the reason of dissatisfaction of students that do not feel good in the school today: *Why you do not feel good in the school today?*



Source: Our own school survey

*Qualitative data analysis example*

**EXAMPLE** From the school survey we know that reason for 20 % of students who did not feel “good” at the school were the relationships with other students (see the example above). So we could use interviews (qualitative approach) to understand what is actually the problem the students have about the relationships (it could be bullying or some other issues).

From the example above you can see that qualitative research (data) are well suited to explain and better understand the findings from quantitative research, which give us “just” the measurement (how many students) but we might not still understand the reasons (what is behind it – the Why).





#### 4.3.2. How to assess relevance of evidence

As in a detective story we should look for evidence supporting our claims and arguments. Mostly, when arguing, it is pointed at “facts” as an evidence that something have happened or when explaining an issue. But it is important to notice that “fact” as itself does not have to be providing solid evidence.

**Evidence** – data proving or disproving that something has happened or that is has certain properties.

There could be many approaches to asses and understand the evidence (e.g. legal evidence, forensic approach etc.). As our goal is **responsible decision making** we have to keep in account that in the real word (compared to designed experiment) we will deal with **incomplete evidence to make the decisions (there will be some unknowns)**. Therefore it is important to understand the relevance of evidence in explaining the concerned issue. And we as an “ACTIVE citizens” should also ask the question about the **impact of an action**. As such **we will mostly need to answer question whether something was caused by something or might cause it in the future – in other words what impact the action (intervention) had or is expected to have.**

For our purposes to assess and understand evidence we can best adapt approach from **Process Tracing method** used in evaluation practices<sup>3</sup>. In short, it is method to be used to **test for causation**. So the purpose of this approach is to assess whether we can **link the effect (impact) with the cause (intervention)**. Hence we speak of: “**establishing causation,**” or “**confirming**” or “**eliminating**” an hypothesis.

---

<sup>3</sup> For our purposes we adapt just some of the aspects of the Process Tracing. For further reference you can use following sources: [Straws-in-the-wind, Hoops and Smoking Guns: What can Process Tracing Offer to Impact Evaluation?](#) by Melanie Punton or [Understanding Process Tracing by David Collier](#)



**FOUR EVIDENCE TESTS FOR CAUSATION:**

|   |            | Sufficient To Establish Causation   |   |
|---|------------|---|---|
|   |            | NO  | YES   |
| <b>Necessary to Establish Causation</b> | <b>NO</b>  | <p style="text-align: center;"><b>Straw in the Wind</b></p> <p style="text-align: center;"><i>Neither necessary nor sufficient to confirm a hypothesis</i></p> <p>Gives slightly more confidence to the hypothesis, but this is not enough to conclusively prove it or to disprove alternative hypotheses but it weakens them (e.g. motive).</p> <p>Serves as a hint that we should follow and investigate further, but cannot be considered as a prove.</p> <p>However multiple evidence can however add up to important evidence.</p> | <p style="text-align: center;"><b>Smoking Gun</b></p> <p style="text-align: center;"><i>High uniqueness: sufficient to confirm hypothesis</i></p> <p>Gives confidence to confirm the hypothesis.</p> <p>But not finding such an evidence does not disprove the hypothesis.</p> <p>Finding such an evidence in the real world might be complicated but still try to look for it.</p>   |
|   | <b>YES</b> | <p style="text-align: center;"><b>Hoop test</b></p> <p style="text-align: center;"><i>High certainty: necessary to confirm a hypothesis</i></p> <p>Affirms relevance of hypothesis, but does not confirm it.</p> <p>Failing the test exclude/disconfirms the hypotheses (e.g. strong alibi).</p> <p>When formulating conclusion asses all the necessary assumptions that have to be met to consider the conclusion to be correct.</p>   | <p style="text-align: center;"><b>Doubly Decisive test</b></p> <p style="text-align: center;"><i>Necessary and sufficient to confirm a hypothesis</i></p> <p>Gives confidence to confirm the hypothesis.</p> <p>If the evidence disproves the test we can also disprove the hypothesis.</p> <p>Finding such an evidence in the real world is limited but still try to look for it. And always be careful to assess the conditions for considering the evidence as relevant (see below).</p> |

*Source: own design based on suggested sources*



**EXAMPLE Straw in the Wind**

*EXAMPLE:* Motive for murder (she left the accused man with another lover, the accused man gain profit from the death of the victim).

*EXAMPLE:* Suspect someone doing something because he/she gained profit from it. That someone profited from the result, does mean that he/she did it (cause it).

**EXAMPLE Hoop test**

*EXAMPLE:* Lacking a good alibi is not enough on its own to prove the hypothesis (convince for murderer). But strong alibi disproves hypothesis that the suspect could be the murderer.

**EXAMPLE Smoking Gun**

*EXAMPLE:* Suspect was found holding a smoking gun over the death body.

**EXAMPLE Doubly Decisive test**

*EXAMPLE:* The murder was filmed on camera showing the suspect stabbing the victim with knife. BUT be careful not to forget some conditions for considering the evidence as relevant (Could not the video be altered? See the important remark below)

*EXAMPLE:* Climate change: the temperature is changing need to be true (important is that we have the means to measure it)

**IMPORTANT** Be careful not to forget some **conditions for considering the evidence as relevant**. As evidence could be wrongly assessed as doubly decisive. As for example: Could not the video be altered? Does what we see on the video corresponds with other evidence as was proven murder weapon (knife, type of gun used), fatal wounds caused the death of the victim etc.? **The evidence must be always considered in the context and be consistent with other evidence.**

**IMPORTANT** NOT all data/facts/evidence is equal to be considered when looking for and finding explanations for issue concerned. **The reliability, validity and completeness of the evidence (data used as evidence) must be assessed and considered** (see Module 1 how to assess the Quality of data and information).

**(SUMMARY) Take into the class** Make sure that students understand different “strength” of evidence available concerning the concerned issue.



### 4.3.3. How to come to conclusions

Based on evidence (data and information) that was assessed we should prove or dismiss the hypothesis:

**Hypothesis** – for our purposes we understand hypothesis as a statements (explanation, argument) that could be further examined/tested (at least to some extend)\* to be proven or disproved based on evidence.

\* In the complex word we might not come to full or 100% prove of something so we have to be aware of the strength of evidence and the level of “certainty” we can judge (prove or disprove) something.

Table that can be used to asses hypothesis or arguments:

| Hypothesis / Argument                         | Criteria (evidence to prove it)*  | Data source**                           | Strength of the evidence                     | Explanation (understanding)   |
|---|---|---|--|---|
| Formulate the hypothesis                      | What criteria are need to be full filed   | Source of data                          | Test the hypothesis                          | How, why. Functions, process  |
| <i>Example 1: Climate change is occurring</i> | <i>..temperature is rising by xx degrees during the last xx years...</i>  | <i>NASA, and xxx (other sources)...</i> | <i>Proven (passing Doubly Decisive test)</i> | <i>Explanation of what is happening and the mechanisms (see that those explanations might by themselves become hypothesis to be tested)</i> |
| <i>Example 2: Jon does not like me</i>        | <i>John he has posted several hate comments on social media about me.<br/><br/>I have confronted him and he acknowledged that he hates me</i> | <i>Social media posts<br/>Interview</i> | <i>Strong (passed Smoking gun test)</i>      | <i>The reason Jong hates me based on the talk I had with him...</i>   |

\* Do not forget to ask whether is the criteria and the evidence available really relevant and sufficient to prove or disprove the hypothesis (Were all the relevant aspects of the issue considered? Se Module 2 and 3).

\*\* Do not forget about reliability, validity and completeness of data (see Module 1)

**SUMMARY) Take into the class** Use the above approach in the class to structure arguments and understanding (explanation) about the concerned issue.



#### 4.4. Basic principles when making sense of information

"CONFIDENCE CAN BE DANGEROUS AND OBSTACLE TO SEEKING" (Indian yogi)

What are the attributes for "relevant understanding" that we can use as checklist to assess our understanding about any concerned issue:

- Consider all available data and information
  - ✓ Collect relevant and reliable data and information (see Module 3)
    - Use already existing data and information (desk research)
    - Do a field research to collect primary data
  - ✓ Analyze and interpret data using appropriate methods (see below)
  - ✓ Consider reliability and validity of the available data (see Module 1)
  - ✓ Do not exclude data that does not confirm your hypothesis
    - Be aware of own confirmation and other biases (see Module 2)
- Consider all relevant aspects
  - ✓ Evidence must be always considered in the context and be consistent with other evidence
  - ✓ Examine the relevance of the evidence and understand the context of the issue
  - ✓ Identify relevant problem – the real cause of what is perceived as "problematic"
  - ✓ Understand the actors involved and their perspectives (see Module 2)
  - ✓ If any relevant aspect of the phenomena has been already shown or proved it does not be further overlooked
- Coherence, causation
  - ✓ Evidence must be consistent with other evidence and must be weighted by its strength and relevance
  - ✓ Consider relevant criteria to assess the validity of the arguments
  - ✓ Coherence of the explanation and the arguments
    - logical coherence and coherence of the data/arguments/theories
    - be aware of manipulative techniques (logical fallacy, false dichotomies) (Module 2)
  - ✓ Assess the criteria for confirming or eliminating a hypothesis (based on evidence)
    - Evidence should provide proof for causation – that something happened because of something ...intervention (action) leads to certain impact
- Consistency in the principles
  - ✓ Be consistent with the arguments and the principles you are using to assess evidence
    - be aware of your biases (do not judge differently based on what you are favor of)
- Understand assumptions
  - ✓ When formulating conclusion assess all the necessary assumptions that have to be met to consider the conclusion to be correct (see the Hoop test above)
- Acknowledge what we know and what we do not know
  - ✓ Examine and be aware of the limitations of data, interpretation and evidence (see below)
  - ✓ Consider what are the unknowns
    - Be ready to say: "I do not know" as the worst think is false confidence



**SUMMARY) Take into the class** Use the above as check list for appropriate approach to interpreting data and information.

#### 4.5. Conspiracy theories and bad practices

When explaining conspiracy theory we could actually go in reverse and point out that the above mentioned principles (see chapter 4.4) for making sense of information are not being met by conspiracy theories.

Conspiracy theory mostly use as the **evidence that passed the “Straw in the wind” test**. As an example: someone could have profit from it and so he/she did. But this is not neither sufficient nor necessary evidence to prove the hypothesis (see the above).

Conspiracy theories are mostly violating the above mentioned principles by:

- **Using manipulative techniques and arguments** (see Module 2)
  - Fake experts, scapegoating (finding common enemy), ad-hominem attacks
  - **False dichotomies** (“either-or fallacy” argument): *dismissing one option the conspiracy theory is seemingly providing prove for second option* (without seeing other option(s))
  - **Logical fallacy & incoherence**:
    - to be able to overcome these you in many cases **need to have deeper (at least to some extend) understanding of the issue** otherwise you will not be able to see thought the false dichotomy or logical fallacy “arguments”
      - as logic is based on available data and information (see Module 2), if you do not have access to relevant knowledge about the issue you are actually not able to see the gaps in the arguments
- **Conspiracy theories are often supported by fake information**
  - But on the other hand there is often mistakenly perceived that conspiracy theory have to be based on fake information. That does not have to be the case (false dichotomies and logical fallacy could be used based on facts)
- **Conspiracy theories are Incoherent** (see above)
- **Conspiracy do not see (understand) the assumption they are based on** (see above)
- **Conspiracy theories propagators are using doubt to lead us off**
  - Using doubt as a false argument (actually a False dichotomy) ignoring the relevant evidence (ignoring the real weight and relevance of evidence)
    - that it could be some other cause (something else), that the scientific evidence is uncertain
    - connected with overwhelming the public discourse with abundance of “evidence” (valid or/and fake) (see Representativeness bias in Module 2)
  - Doubt is well documented to be used by Tabaco industry and climate change denials as one of the main tool to spread disinformation<sup>4</sup>

**SUMMARY) Take into the class** Use the above in the class when confronted with conspiracy theory to show students the underlining aspects the conspiracy is based on.

---

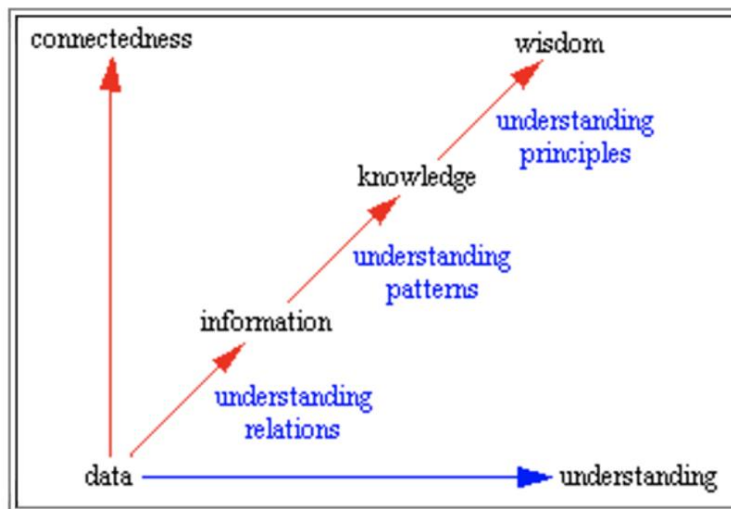
<sup>4</sup> You can find research papers concerning this issue or this topic was quite well adapted by BBC series [How They Made Us Doubt Everything](#).



#### 4.6. Beyond data and information – knowledge and wisdom

Before we dive into concrete approaches how to interpret data and information let us point out that even that we strive to base our decisions on data and logical arguments (evidence) there is always something more in the complex world around us. Thus we should acknowledge that when **interpreting the data, there is always someone (us) doing it**. In this sense acknowledge the following when interpreting data:

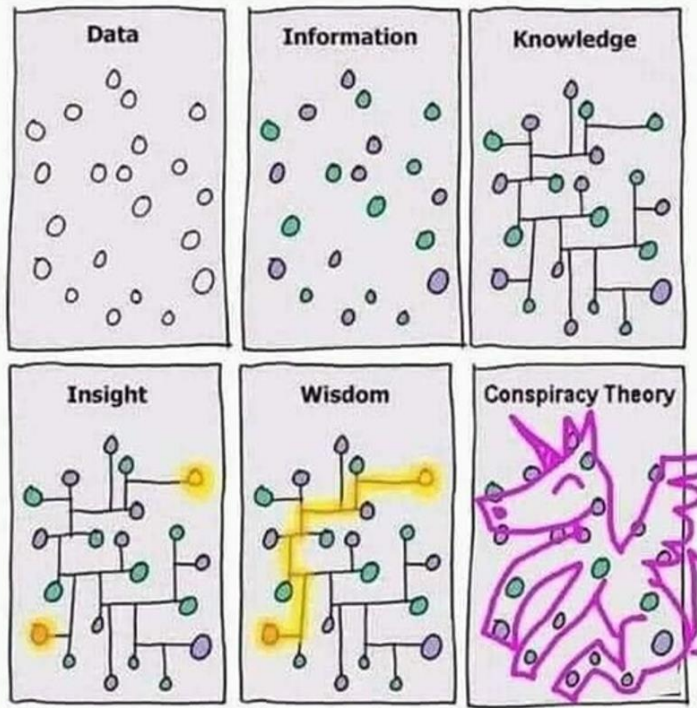
- The **assumptions** that are behind the interpretation (see Module 3 and 4)
- The **biases** that limit us to see the reality as it is (see Module 2)
- The limitations of **language and logic** itself (see Module 0 and 2)
- The limitations to grasp **complex phenomena** and that facts (data) are not the reality itself (see Module 0)
- The limitations of our **resources** and limits to get “all” the relevant data and information we could have (see Module 3)
- The input of the **knowledge and wisdom** that is required to truly understand (in the sense in which it is actually needed to grasp and interpret the data). As we are not a tabula rasa confronted with facts (data). Our experience and knowledge is influencing the approach and methods we use and how we actually see the issue (point of view). Represented by the two pictures below:



Source: Jalaludin, Asep. (2019). *Building Knowledge Sharing Behavior Based on Social Media With DIKW Model in Paguyuban Asep Dunia (PAD)*.



Data considered as facts, sketches, drawings or raw materials become information, if they are given context. Therefore, information is data with specific meaning. When this information is combined with opinions, expertise, and experience, it becomes knowledge<sup>5</sup>. When insights of deep understanding and acknowledging the uncertainties and limitations are integrated we can call it wisdom. When connecting pieces of data without relevance and coherence it will become conspiracy theory.



Source: unknown

---

<sup>5</sup> Taken from (with some editions) from: Source: Jalaludin, Asep. (2019). Building Knowledge Sharing Behavior Based on Social Media With DIKW Model in Paguyuban Asep Dunia (PAD).