

# METACOGNITION aka KEEPING TRACK OF YOUR OWN LEARNING

Opening questions for the reader before reading:

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- Do you analyse your own thinking process or ways of learning? Why? If yes, how?
- Do you assess or keep track of how well you know the topics that you learn? Why? If yes, how?

First we need to introduce a somewhat strange word called metacognition.

**Metacognition can be defined as:**

- Awareness or analysis of one's own learning or thinking processes.<sup>1</sup>
- Planning, monitoring and evaluating your own learning, reflecting on your own performance.<sup>2</sup>



A very simple example: making notes in a lesson is cognitive strategy (to remember the lesson), **deciding that you need to make notes in order to remember** the lesson is a metacognitive strategy.<sup>3</sup> Metacognition is thinking about your learning, not learning itself, for example, what helps you to remember; but also the knowledge of good strategies to learn and think **in order to become better at something**.

Metacognition is an essential part of self-development and learning. It has been said that we might learn more from reflecting on our experiences than from the actual experiences themselves.<sup>4</sup> The human brain is a very complex organ, which brings both many possibilities and struggles with it. It's been well studied<sup>5</sup> that we have many biases that distort the way we process information and we can make "shortcuts" in our thinking that can bring mental flaws into our logic. Becoming better at thinking and learning can often be counter-intuitive and requires practice and effort.

It's important to note that metacognition is a rather complex topic and we are only very briefly touching upon it here. **Good metacognition means being able to assess if we are learning effectively or ineffectively and how we should change our learning strategies.** It's a whole process of mindfully planning, monitoring and then evaluating our learning.

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<sup>1</sup> [Merriam-Webster Dictionary](#)

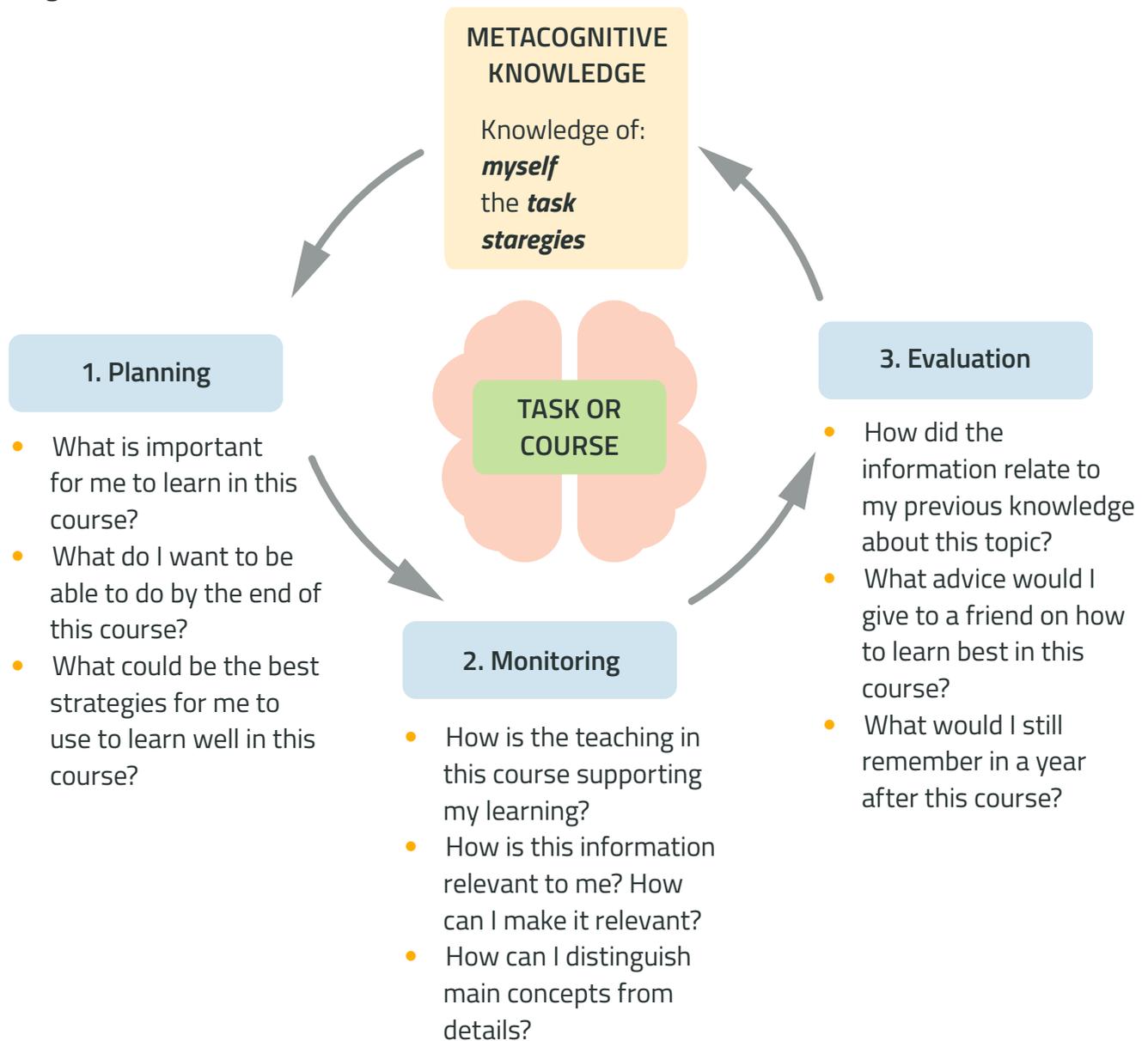
<sup>2</sup> National Research Council (NRC) (1996). National Science Education Standards, Washington, DC: National Academies Press

<sup>3</sup> Jacobse, A. E., & Harskamp, E. G. (2012). Towards efficient measurement of metacognition in mathematical problem solving. *Metacognition and Learning*, 7(2), 133-149.

<sup>4</sup> Dewey, J. (1933). *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*.

<sup>5</sup> variety of examples in: Kahneman, D. (2011). *Thinking, Fast and Slow*.

Some examples of metacognitive questions that a learner could ask him/herself in each of these stages:



Source: Tanner (2012)<sup>6</sup>, Quigley et al (2018)<sup>7</sup>

Developing metacognitive skills is a long process and not something our training courses can teach people to master. But there are some elements which we have included in order to help learners to assess their learning process better and practice metacognitive skills. That's why we have included the ability to self-assess their own skill level and direct their learning more effectively as a part of the Zero Waste Ambassador's competences. Similarly, one of the Zero Waste Trainer's competences is to critically evaluate their own teaching and welcome failure as part of the learning process. Teaching is always also a learning process.

<sup>6</sup> Tanner, K.D. (2012). Promoting Student Metacognition. *CBE - Life Sciences Education*, 11, 113–120.

<sup>7</sup> Quigley, A., Muijs, D., & Stringer, E. (2018). [Metacognition and self-regulated learning. Guidance Report](#), Education Endowment Foundation.

For each of our chapters in the handbook we have added opening and ending questions which help to think about what we already know about the topic, what we can do with this knowledge and what we want to do next. This is similar to what we recommend to do during training events:

1. In the beginning thinking about what learners already know about the topic;
2. In the evenings having reflection exercises: ideally learners could write down the most important learning moments and how to use them in the future.

We encourage learners to be confused and to struggle. And perhaps most importantly to notice that **deliberate confusion can also be a metacognitive skill** - to consciously understand what we don't yet understand and what is difficult.



**Reflecting on our own learning only based on how it FEELS effective to us is not enough. Why is it so?**

It is well studied<sup>8</sup> that the majority of what we believe about our own learning is not correct. For example, if learning feels hard and confusing, we tend to think that we are not good at the topic and the learning process is ill-designed, although the truth is likely the opposite. In order to become a ninja in metacognition, a crucial aspect is to integrate everything you learn about learning into your self-reflection. This is mainly in the *Main principles of teaching* chapter but also the *Learning motivation* chapter of the Zero Waste Trainer section of the handbook.

In this chapter we offer two exercises for Zero Waste Ambassadors and Trainers. One of them is the **self-assessment questionnaire** where different Zero Waste Ambassador and Trainer competences can be rated and reflected on what kind of proof there is for the presence or lack of those competences. The second is **a self-test** – three real life situations where either Zero Waste Ambassador or Trainer knowledge needs to be applied. It is meant to help assess **the gap that we can have between what we think we know about the topic and what we actually know.**

#### Additional metacognitive questions after these exercises could be:

- How easy or difficult was it for you to assess yourself? Why was it so?
- How similar or different were your answers in the self test from that of an expert? What could be the reasons for that?
- In what ways could you plan, monitor and evaluate your learning in the future?

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<sup>8</sup> Soderstrom, N. C., & Bjork, R. A. (2015). Learning versus performance: An integrative review. *Perspectives on Psychological Science*, 10(2), 176-199.

# ZERO WASTE AMBASSADOR SELF-ASSESSMENT QUESTIONNAIRE

These questions could help you to map your strengths and struggles. They have been grouped by more broader topics but can also be assessed in more detail. It's important to reflect on the reasoning and proof that you add to your assessments.

This questionnaire can be filled before reading any of the handbook chapters, and then checked again after reading and the self-test.

## Technical competences

Knowledge of zero waste basics:

- What is zero waste, what is it now, why is it important
- What is a Zero Waste City
- Preferred waste management, reduction and treatment options

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

Ability to work with data, knowing the importance of data

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

## Policy, advocacy competences

Importance of waste prevention and reduction policies

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

Ability to apply the zero waste principles to different practical contexts

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

Ability to advocate for zero waste and convince different stakeholders

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

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### Soft skills/competences

Knowledge of different zero waste stakeholders and ability to communicate between them

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

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1      2      3      4      5      6      7      8      9      10

General soft skills: Empathy, positivity, patience, confidence

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

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## ZERO WASTE AMBASSADOR SELF-TEST

One of the best ways to test our knowledge of something is to put it into practice, into real-life situations. Here are three scenarios. Read them and first think through how you would respond without looking at any written material. You could even write down your answers and only then compare them with some of the ideas from experts on page 22.

- 1.** A municipality is looking to reduce its organic waste and comes to you seeking advice.
  - 1.** Currently it offers a separate collection of organics but it is not mandatory – citizens can buy the bags themselves if they want, which will be collected if left out on the street ahead of the designated collection day. There is very little home-composting done because not many households or businesses have gardens. The rest of the organics are sent 100 km away to an anaerobic digestion site. What are your first thoughts: what additional info would you need, who would you want to talk to, what could be your first steps?
  
- 2.** Your local municipality has landfilled all of its non-recycled waste in the past. Yet the landfill is now almost full. The municipality is deciding which disposal option to consider – whether to extend the landfill site, build an incineration plant, or decide on a separate/ alternative option. What are your first thoughts: what additional info would you need, who would you want to talk to, what could be your first steps?
  
- 3.** Your municipality wants to reduce its carbon footprint, and it has identified the waste and resource sector as one area where GhG emissions could be much lower. It wants to reduce GhG emissions across the city by 50% within the next 10 years and wants the waste sector to play a leading role in this transition. Municipal officials come to you for policy advice and guidance. What are your first thoughts: what additional info would you need, who would you want to talk to, what could be your first steps?

# ZERO WASTE TRAINER SELF-ASSESSMENT QUESTIONNAIRE

These questions could help you to map your strengths and struggles. They have been grouped by more broader topics but can also be assessed in more detail. It's important to reflect on the reasoning and proof that you add to your assessments.

This questionnaire can be filled before reading any of the handbook chapters, and then checked after reading and the self-test.

## Educational psychology competences

Ability to create motivating learning environments, by supporting the three basic psychological needs of learners

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

Ability to support long-term learning instead of short-term performance

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

Ability to assess the learning outcomes of planned educational activity

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

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### Topical (zero waste) competences

Knowledge of zero waste principles and practices in different contexts

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

Understanding of why and how misconceptions occur and how to overcome them, knowledge of the main zero waste misconceptions and how to work with them

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

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1      2      3      4      5      6      7      8      9      10

Ability to transform zero waste skills and knowledge into educational activities

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

1      2      3      4      5      6      7      8      9      10

### Soft skills/competences

Confidence to perform in public, ability to adapt to the changes in learning setting, ability to improvise

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

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Patience, empathy, open and warm curiosity towards oneself and towards the learners' perspective, especially in moments of stress/misunderstandings

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

(1- not at all competent, 10 - very competent)

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Ability to critically evaluate your own teaching and welcome failure as part of the learning process

**How competent do you feel in it, on the scale of 1-10? Based on what do you think so?**

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## ZERO WASTE TRAINER SELF-TEST

One of the best ways to test our knowledge of something is to put it into practice, into real-life situations. Here are three scenarios. Read them and first think through how you would respond without looking at any written material. You could even write down your answers and only then compare them with some of the ideas from experts on page 23.

**1.** You are at a conference. During lunch break you start chatting with a company owner, who proudly tells you that they are also moving towards circular economy, for example all their waste is used to create energy. What are your first thoughts on how to respond to her/him?

**2.** You are asked to give a 2h training session to a bank on zero waste – what they can do at the office, in their events, in everyday life. Describe your first thoughts on how would you prepare and set up this session.

**3.** You were invited by the environment officer to give a 1.5 h session at a municipality, with the aim to educate all the municipality staff on zero waste. You know that some people are quite enthusiastic about the topic, while there are also some old school skeptics. What are your initial thoughts on how to start your session and what to try to keep in mind during the session while communicating with your audience?

## EXPERT THOUGHTS ABOUT AMBASSADOR TEST SCENARIOS

Besides comparing your answers with the ones from an expert, you can go through different Zero Waste Ambassador chapters to see if you can find out why we have responded this way here.

- 1.** Since the goal is a reduction of organic waste amounts, enabling and encouraging home, community and/or business composting is a sure way to get it done. Making separate collection mandatory would shift the waste from the residual stream to a separate one, may reduce the amounts through evaporation if collected in permeable bags, and enable giving more economic incentives to residents to choose home/community composting instead. An increased organic waste stream will make transporting the waste economically inefficient, while making a new local composting or Anaerobic Digestion facility more viable. For reduction at source the municipality could implement awareness raising and educational campaigns, challenges, research, good practices from elsewhere and provide funding for action/innovation.
- 2.** First the time scale needs to be clarified – how much time is remaining until the landfill is full? If it's a matter of months, then there's no choice but to find some other existing disposal option first, and then think of other measures. Otherwise the Zero Waste Hierarchy should be followed, preferring extending/replacing the landfill over incineration, while at the same time launching work on waste prevention and residual minimization. Depending on the capacities, timelines and ambition, costs for a new disposal site might be avoided.
- 3.** First think of how the GhG inventory is being done. If it's just the default, where the waste sector is represented only through methane emissions from landfills, all the effort should go towards banning landfilling of unstabilized waste and reducing organic content, which is easier when you have separate collection of organic waste. If they are looking at it holistically, then all possible waste prevention measures are candidates for implementation and priority should be given to those with largest potential gains. This will largely depend on the current waste generation and management systems, level of awareness and engagement of the residents and the wider regional or national frame.

## EXPERT THOUGHTS ABOUT TRAINER TEST SCENARIOS

Besides comparing your answers with the ones from an expert, you can go through different Zero Waste Trainer chapters to see if you can find out why we have responded this way here.

- 1.** It seems the owner has a misconception about waste-to-energy being a good solution. Delay your wish to explain why it's not a good idea. First give some recognition of his/her wish and attempt to be more circular. Then try to get more information about what specific solution they are actually using and why does he/she think it's circular and if they have also seen some other solutions. Try to get him/her to question the misconception through questions instead of explaining and maybe get him/her interested in wanting to know more about it.
- 2.** Ask for a possibility to do two shorter trainings instead of one, to get the chance to meet the people at least twice, so there could be a possibility to do retrieval and strengthen their learning, and explain why you suggest that. Try to get to know their pre-knowledge before the training or at least in the beginning of the session. Start the session with some questions or a task to activate their thinking, ask what they are already doing, what do they consider as zero waste practices, if and why is it important to them. Build on questions and let them do most of the talking, offer your suggestions and thoughts only after their own ideas. Point out similarities and differences in their and your (the expert) views as well as their reasons, that is why some ideas are effective from zero waste perspective and why some are not. Try to get them thinking about the bigger environmental impact of the bank like their funding and loan principles.
- 3.** It's important to support the three psychological basic needs of all of them. Start by creating relatedness, ask for their ideas and interest. If some say they don't think zero waste works, show genuine open curiosity and ask why they think so? You can give examples of places where zero waste has been implemented and what it has changed in the bigger picture and ask why they think it worked there? Give enough explanations, and include everyone into a common discussion. Accept the emotions of the skeptics, show respect to their thoughts and discuss all their ideas equally. If they express ideas that are not correct, say why they are not true and definitely support those ideas that are true.