ELIXIR-EXCELERATE
Train The Trainer

Why are we here?

- Learning principles
- Training techniques
- Lesson, session, course, and material design
- Assessment and feedback

- **Session 1**: Principles of learning and how they apply to training

- **Session 2**: Training techniques that can be used to enhance learner engagement and participation

- **Session 3**: Session, course, and materials design

- **Session 4**: Assessment and feedback in training

Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn

H.A. Simon (one of the founders of the field of Cognitive Science and Nobel Laureate) 1916-2001

We cannot talk about teaching, teaching practices or effective teaching techniques if we don't understand first how people learn

How learning works

Challenge: How do you go about learning something new ? How do you approach learning new things? (3 min + 5 min)

- Read about it

- Attend a training session !

- Have a go ?

- Do, reflect, process, further understand?

Which is the most effective approach for *you* to learn?

Make a list of three approaches that work for you when you want to learn something new (from the most to the less effective one). Discuss it with your partner and compare.

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From Willingham (2009) "Why don't students like school?":

- Learning is a change in the long term memory

How learning works

- What is learning?
- Which learning theory?

How learning works: Seven research-based principles for smart teaching (Ambrose, et al. 2010)

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- **Principle P6**: Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning
- **Principle P7**: To become self-directd leaners, students must learn to monitor and adjust their approaches to learning.

Our pedagogical model is based on the following concepts, ideas, and models:

- The difference between teaching and training
- Adult learning or andragogy
- The Bloom's six categories of cognitive skills
- How thinking and memory work
- The acquisition of skills: novices, competent practicionners, experts
- Cognitive development and mental models
- The importance of the learning environment
- Active learning

Teaching or Training?

Challenge: Based on your experience, what are in your opinion the differences between teaching and training? (5 min)

- Make a list of three main differences. Discuss with your partner(s). Write each on a different sticky note.

Adult learning or andragogy

Challenge: what learner are you today?

- Think about your experience as a learner when you were at school, and the learner you are now in this course.
- Write one thing in which you feel different as a learner today from the learner you were at school.
- Write it on a sticky note

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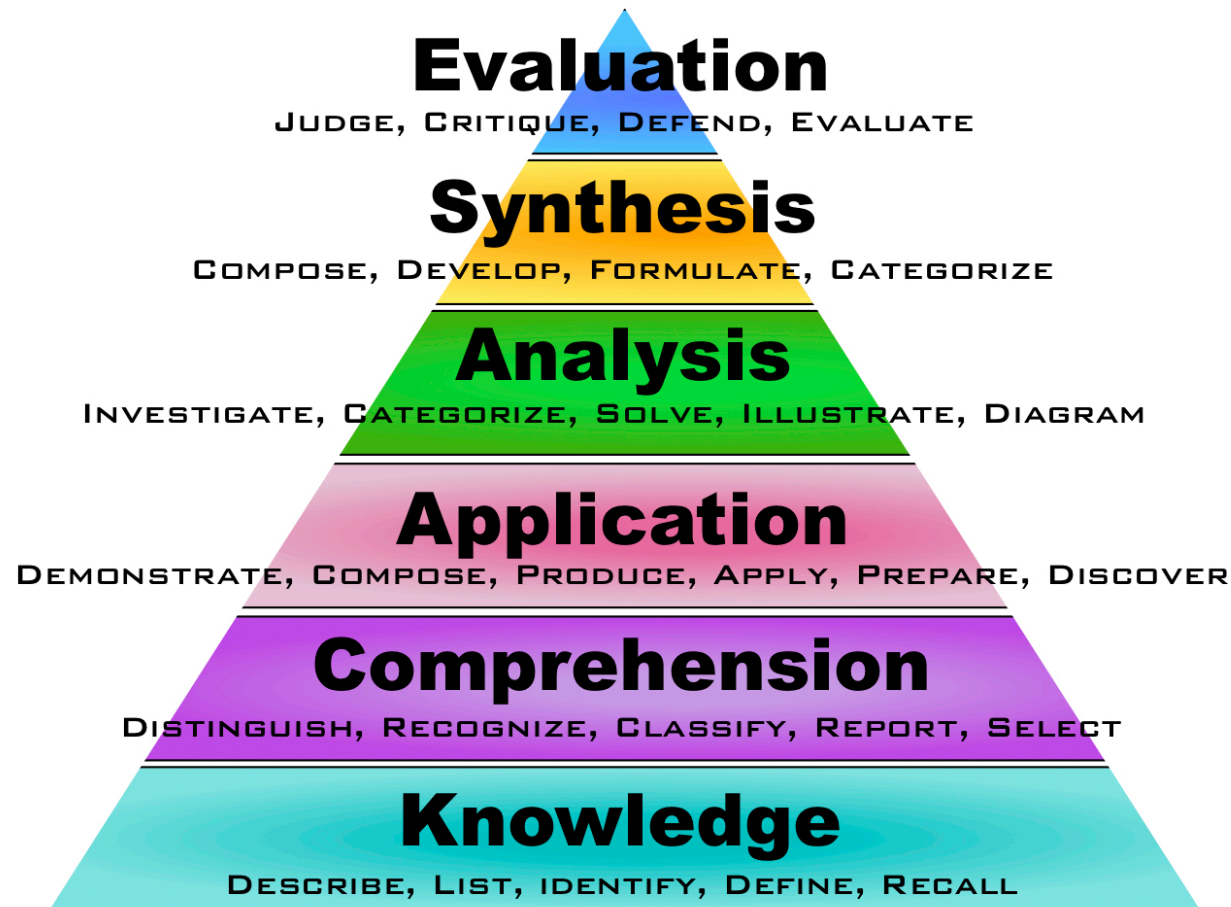- are more practical learners, wanting to be able to apply what is learned

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- are more practical learners, wanting to be able to apply what is learned
- prefer to be treated as partners in the learning experience

The Bloom's six categories of cognitive skills

Evaluation
JUDGE, CRITIQUE, DEFEND, EVALUATE

Synthesis
COMPOSE, DEVELOP, FORMULATE, CATEGORIZE

Analysis
INVESTIGATE, CATEGORIZE, SOLVE, ILLUSTRATE, DIAGRAM

Application
DEMONSTRATE, COMPOSE, PRODUCE, APPLY, PREPARE, DISCOVER

Comprehension
DISTINGUISH, RECOGNIZE, CLASSIFY, REPORT, SELECT

Knowledge
DESCRIBE, LIST, IDENTIFY, DEFINE, RECALL

The Bloom's six categories of cognitive skills

1. **Remember/Reiterate** - performance is based on recognition of a seen example(s);
2. **Understand/Summarise** - performance summarizes information already known/given;
3. **Apply/Illustrate** - performance extrapolates from seen examples to new ones by applying rules;
4. **Analyze/Predict** - performance requires analysis and prediction, using rules;
5. **Create/ Synthetise** - performance yields something innovative and novel, creating, describing and justifying something new from existing things/ideas;

How can we use the Bloom's hierarchy of cognitive skills in teaching and training?

- We can use the Bloom's taxonomy to align instruction with learners' levels of complexity of thinking (and experience).

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- How? We can use it to:
  - identify teaching objectives and learning outcomes
  - design instruction and learning experiences
  - assess learning

Teaching objectives and Learning Outcomes

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1) Think about what learners will be able to do by the end of instruction

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5) Keep in mind that learning outcomes can be as specific as you want. You may even think about a different learning outcome for each task you assign to learners.

Measurable verbs to assist you in writing and assessing learning outcomes

https://github.com/ppalagi/EXCELERATE-TtT/blob/master/docs/learning-outcomes.md

Teaching objectives and Learning Outcomes

Challenge

- Write a Teaching Objective AND a Learning Outcome for a lesson or a session you usually deliver.

The acquisition of skills: novice, competent practicionner, expert

Dreyfus model of skill acquisition

| Novice | Advanced beginner | Competent | Proficient | Expert |

Rules →→→→→→ Intuition

Novice	Competent Practitioner	Expert
" I'm not sure what questions to ask "	" I'm pretty confident, but I still look stuff up a lot! "	" I've been doing this on a daily basis for years! "

Experience level

The acquisition of skills: novice, competent practicionner, expert

- **Novice**: someone who doesn't even know what questions to ask

- **Competent practitioner**: someone who has enough understanding for everyday purposes

- **Expert**: someone who can easily handle situations that are out of the ordinary

The acquisition of skills: novice, competent practicionner, expert

Challenge

- Think about a topic/field you feel you are a novice, a topic you feel you are a competent practitioner, and one you feel an expert, and share this with us.

Mental models

A mental model is a collection of concepts and facts, along with the relationships between those concepts, that a person has about a topic or field.
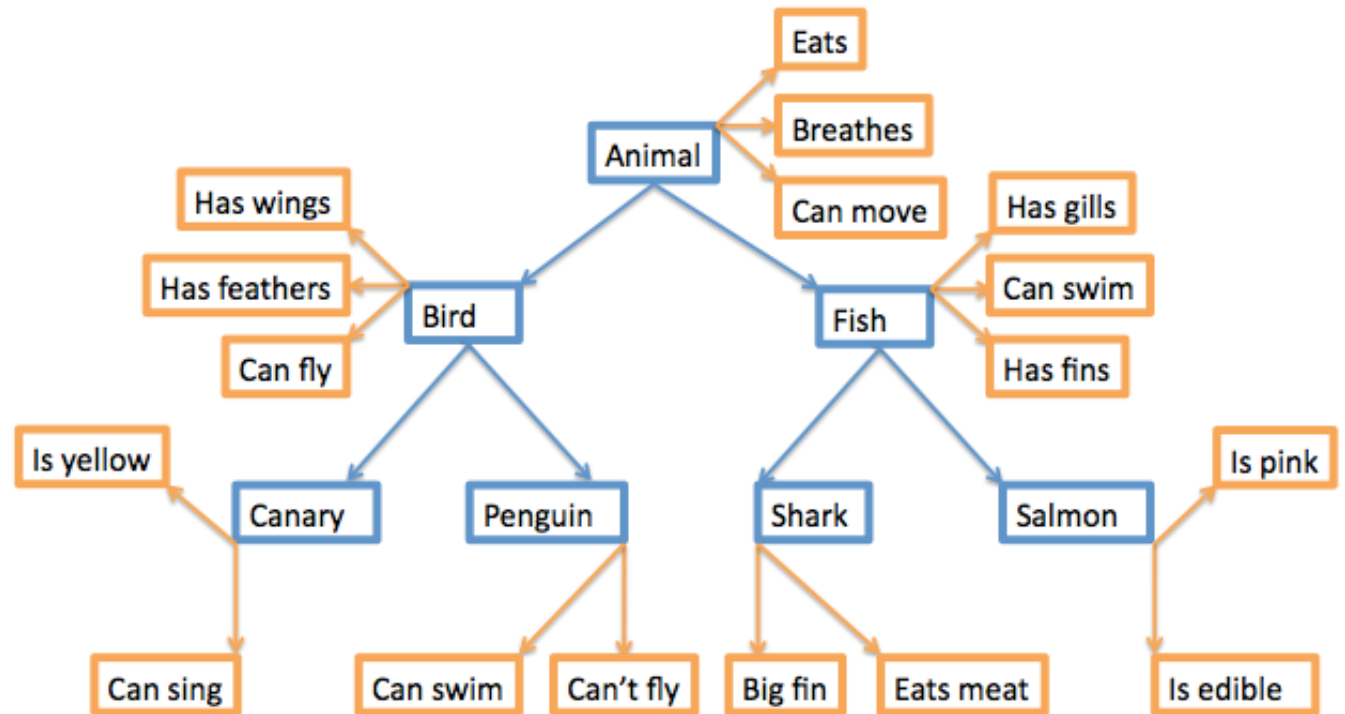
Novice, competent practitioner, expert: in what do they differ?

Challenge: What are the main differences between a novice and an expert in terms of knowledge and learning?
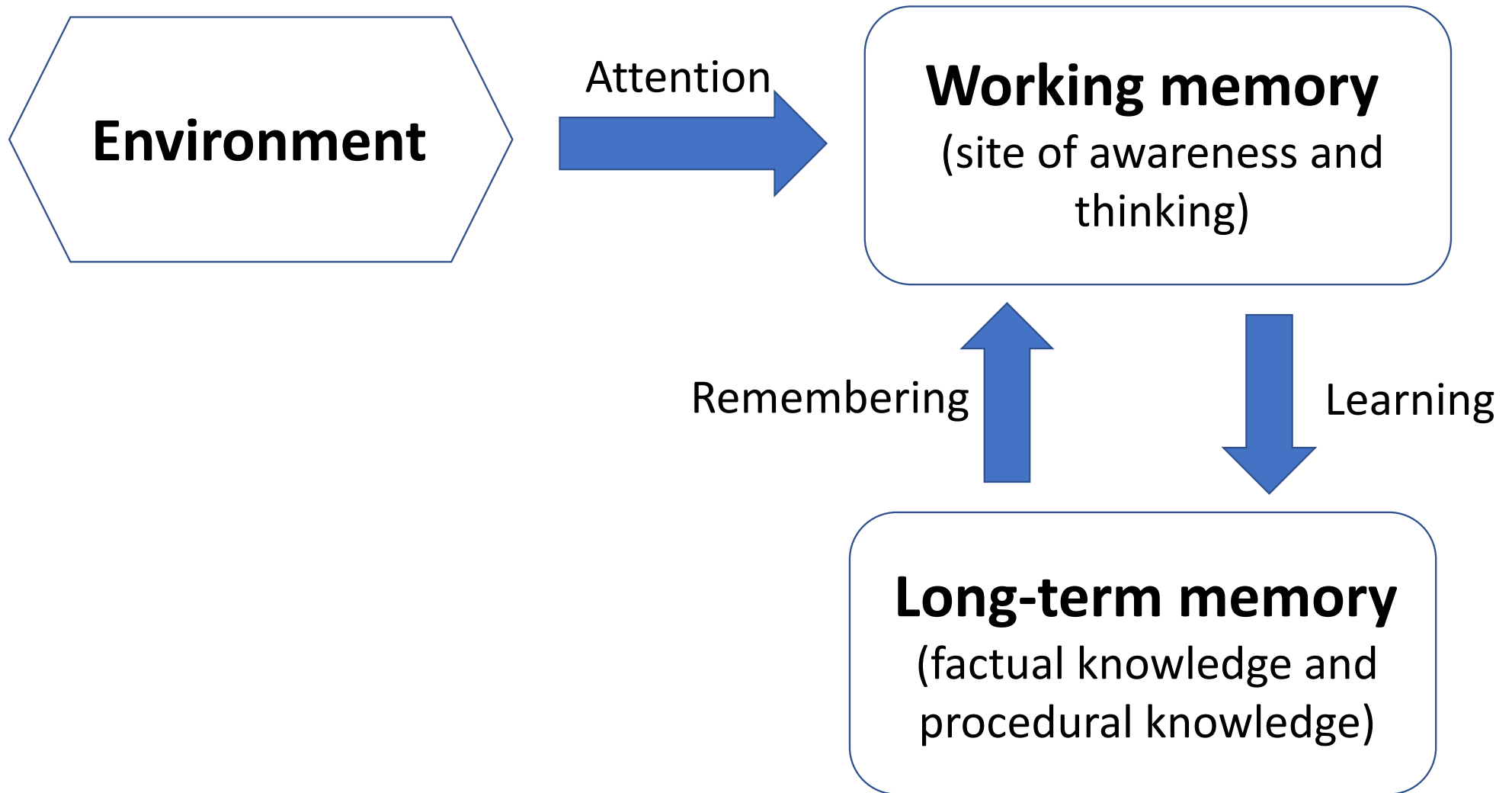
- Think about yourself as a learner.

- How did you feel about something new when you were a student? How was to be a novice? Can you remember it?

- How do you feel today when you have/want to learn something completely new to you? Does it happen sometimes?

- How do you feel when you have to learn something new *in your field*? Namely, something that is an extension of your current knowledge about something (e.g. you know well a given OS and you need to learn how a different OS works).

- Write at least two things in which novices and experts differ.

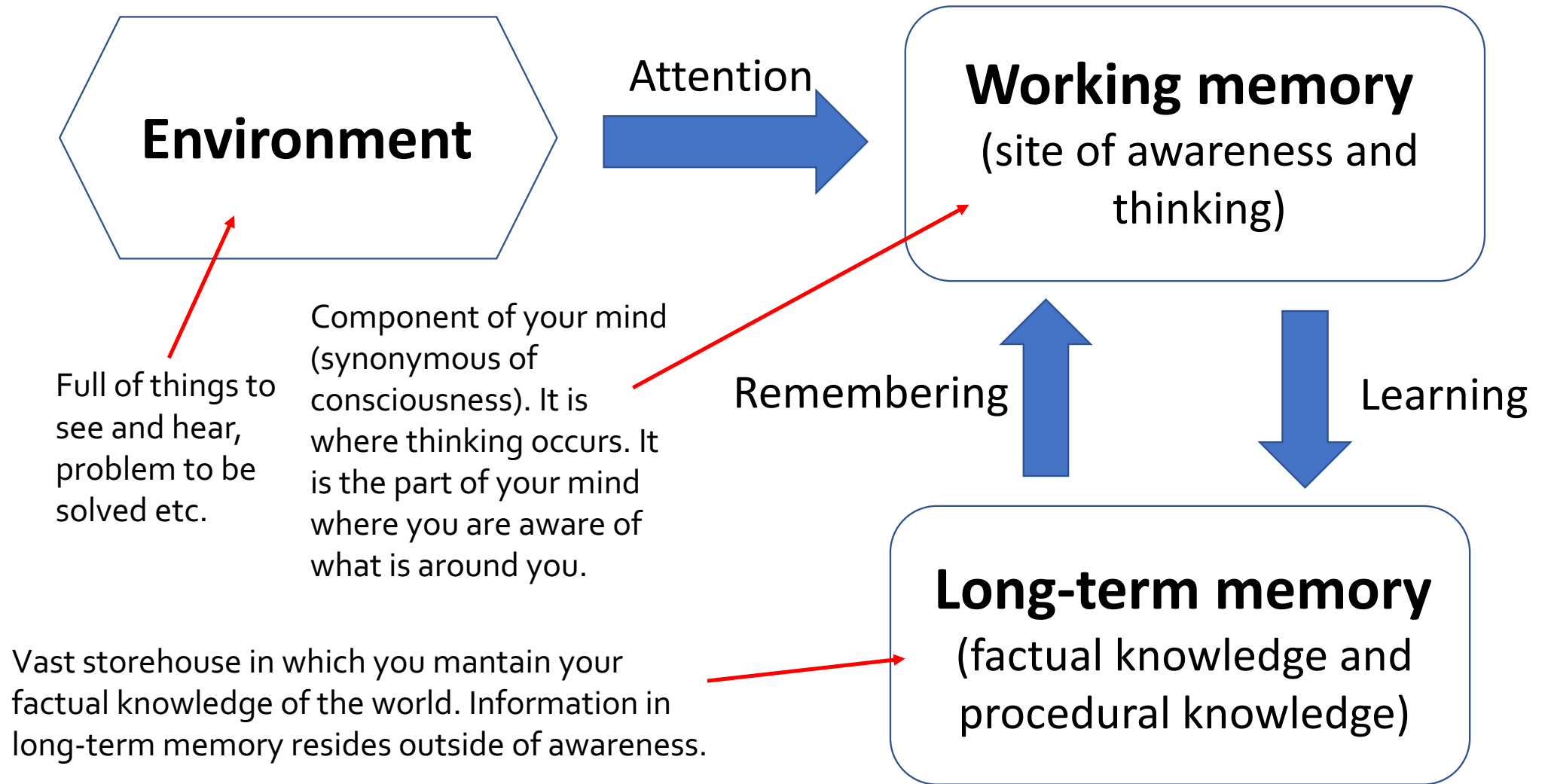# Learners' prior knowledge and misconceptions

P1: How can prior knowledge hinder learning?

- Misconceptions
  - Simple factual errors
  - Broken models
  - Fundamental beliefs

Working memory, long term memory and learning

Environment → Attention → **Working memory**
(site of awareness and thinking)

Remembering ↑ | ↓ Learning

Long-term memory
(factual knowledge and procedural knowledge)

Working memory, long term memory and learning

Environment

Attention →

Working memory
(site of awareness and thinking)

Full of things to see and hear, problem to be solved etc.

Component of your mind (synonymous of consciousness). It is where thinking occurs. It is the part of your mind where you are aware of what is around you.

Remembering

Learning

Vast storehouse in which you mantain your factual knowledge of the world. Information in long-term memory resides outside of awareness.

Long-term memory
(factual knowledge and procedural knowledge)

Long-term vs working memory

- Long-term memory is slow to access but it is essentially unbounded
- Working memory is very fast but has very limited space. Several experiments showed that we can hold in the working memory up to 7 +/- 2 items.
- https://cat.xula.edu/thinker/memory/working/serial

The fact that working memory has limited space, implies that thinking becomes increasingly difficult as working memory gets crowded.

What can we do to make room in working memory?

- Increase our background knowledge
- Avoid extraneous cognitive load

X C N

N P H

D F B

I C I

A N C

A A X

X

CNN

PHD

FBI

CIA

NCAA

X

Other factors facilitating memory

- things that create an emotional reaction will be better remembered, but emotion is not necessary for learning (and it is definitely not sufficient!)

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- practice makes learning long lasting

- spaced practice is of great benefit for memory

Cognitive load

Cognitive load refers to the total amount of mental effort being used in the working memory

- **Intrinsic cognitive load**
- **Germane cognitive load**

- **Extraneous cognitive load**

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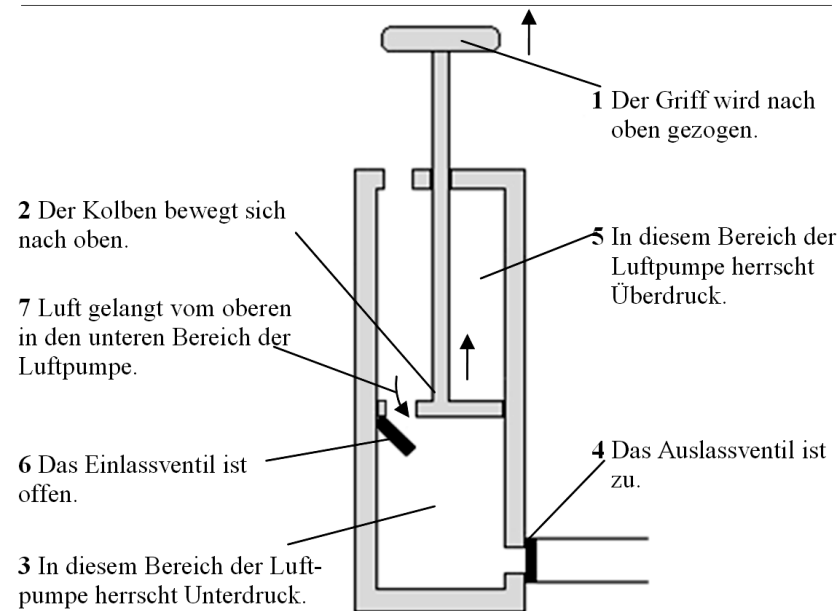
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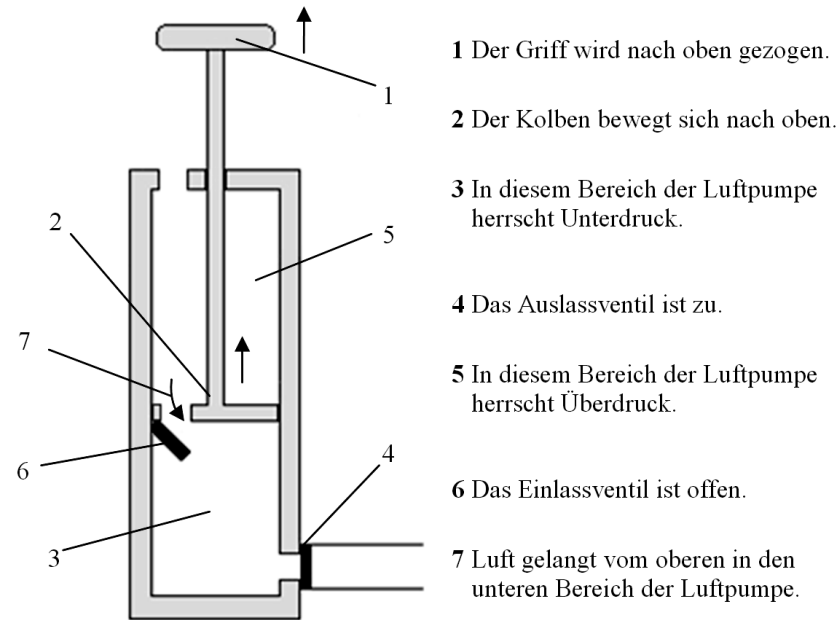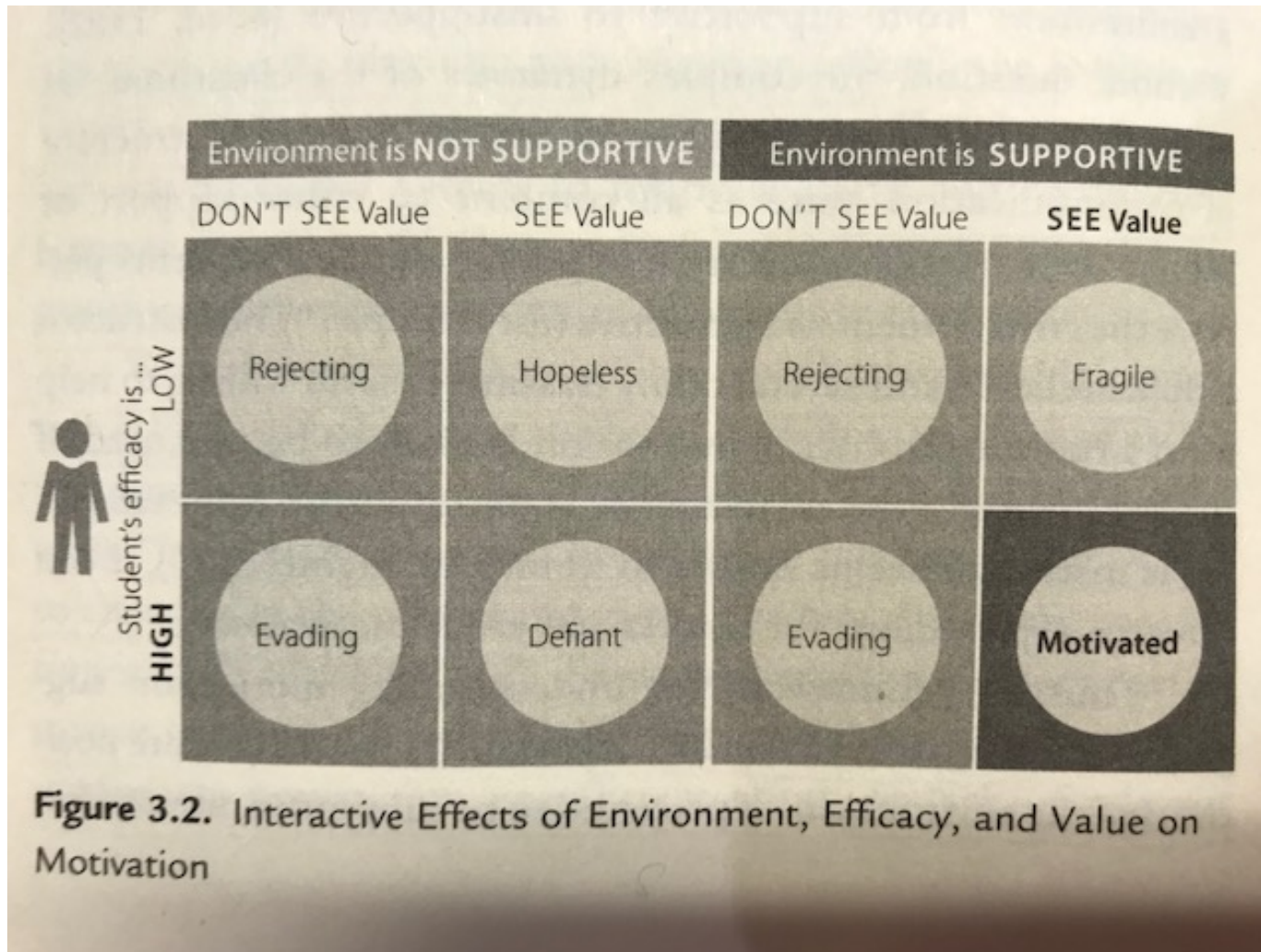
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- **Extraneous cognitive load** is everything else that distracts or gets in the way.

Split attention effect

1 Der Griff wird nach oben gezogen.

2 Der Kolben bewegt sich nach oben.

3 In diesem Bereich der Luftpumpe herrscht Unterdruck.

4 Das Auslassventil ist zu.

5 In diesem Bereich der Luftpumpe herrscht Überdruck.

6 Das Einlassventil ist offen.

7 Luft gelangt vom oberen in den unteren Bereich der Luftpumpe.

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The Learning Environment

Motivation

Figure 3.2. Interactive Effects of Environment, Efficacy, and Value on Motivation

Value

- attainment value
  - satisfaction that one gains from mastery and accomplishment of a goal or task
- intrinsic value
  - the satisfaction that one gains simply from doing the task rather than from a particular outcome of the task
  - It is the source of intrinsic motivation
- instrumental value/extrinsic rewards
  - praise
  - public recognition
  - money
  - material goods
  - an interesting career
  - a high-status job, etc.)

Efficacy

- positive outcomes expectancies for success

- growth vs fixed mindset

- Efficacy expetancies represent the belief that one is capable of identifying, organising, initiating, and executing a course of action that will bring about a desired outcome (Bandura, 1997).

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- In order to hold a positive expectancy for success, learners must not only believe that doing the assigned work can earn a passing grade (growth mindset), **they must also believe that they are capable of doing the work necessary to earn a passing grade**

Environment

- complex dynamics of the classroom

- its tone

- the interpersonal forces at play

- the nature and structure of communication patterns.

- e.g. "The instructor is approachable and several of my classmates seem willing to help me if I run into troubles".

People generally remember...
(learning activities)

People are able to...
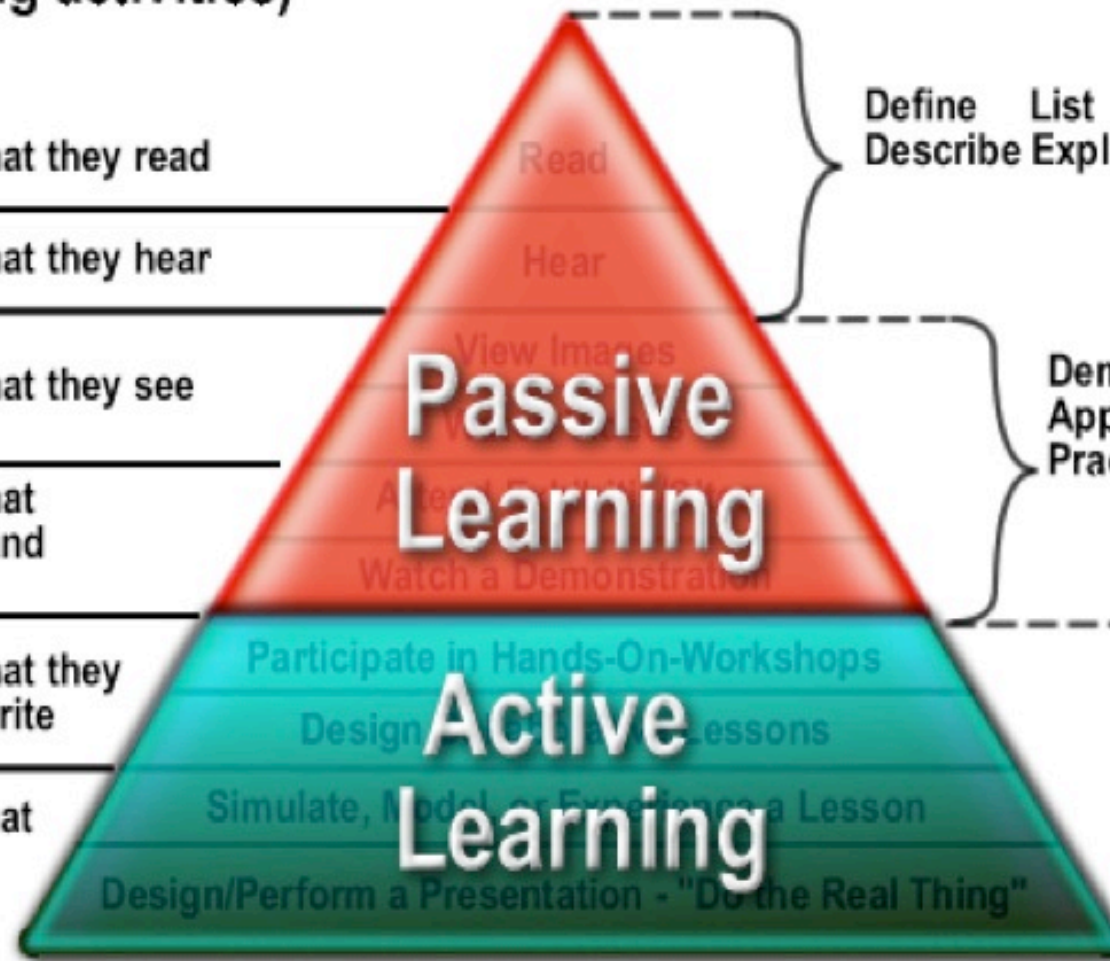(learning outcomes)

10% of what they read

20% of what they hear

30% of what they see

50% of what they see and hear

70% of what they say and write

90% of what they do.

Read

Hear

View Images

Passive Learning

Watch a Demonstration

Participate in Hands-On-Workshops

Active Learning

Design/Perform a Presentation - "Do the Real Thing"

Define List
Describe Explain

Demonstrate
Apply
Practice

Analyze
Define
Create
Evaluate

[Mazur's video on Peer Instruction for Active Learning](#)

Session 2

Training techniques that can be used to enhance learner engagement and participation

What makes a good training session?

Challenge 1: Training you have been involved in...

• What makes a good training session?

• What makes a bad training session?

Think of an example of each that you have participated in and list your thoughts...

What makes a good trainer?

Challenge 2: What makes a good trainer?

- Discuss it in pairs and write down which characteristics you think a good trainer should have

- Identify two essential characteristics that good teachers have in common. Discuss with your partner.

What makes a good trainer?

- Knowledge of subject
- Clear aims for session outcomes
- Confidence in delivery
- Appropriate delivery
- Listens to trainees
- Flexible – can change pace / depth if required
- Approachable
- Engaging

According to experiment described in (Willingham, 2009), effective teachers have two qualities:

- they are able to connect personally with students, and
- they organise the material in a way that makes it interesting and easy to understand (the class is well organised).

The GOBLET skills matrix for trainers

- The TtT taskforce of the Global Organisation for Bioinformatics Learning, Education and Training (GOBLET), developed a skills matrix for trainiers.

- It aims to provide an overview of the major skills required to be a good trainer

- Verbal communication skills
- Written communication skills
- Presentation skills

- Session planning
- Curriculum planning
- Event management

Communication

Planning and Management

Expertise and Knowledge

Trainee Engagement

- Subject area knowledge
- User application awareness
- Knowledge of training methodology

- Flexibility in delivery
- Empathy with trainees
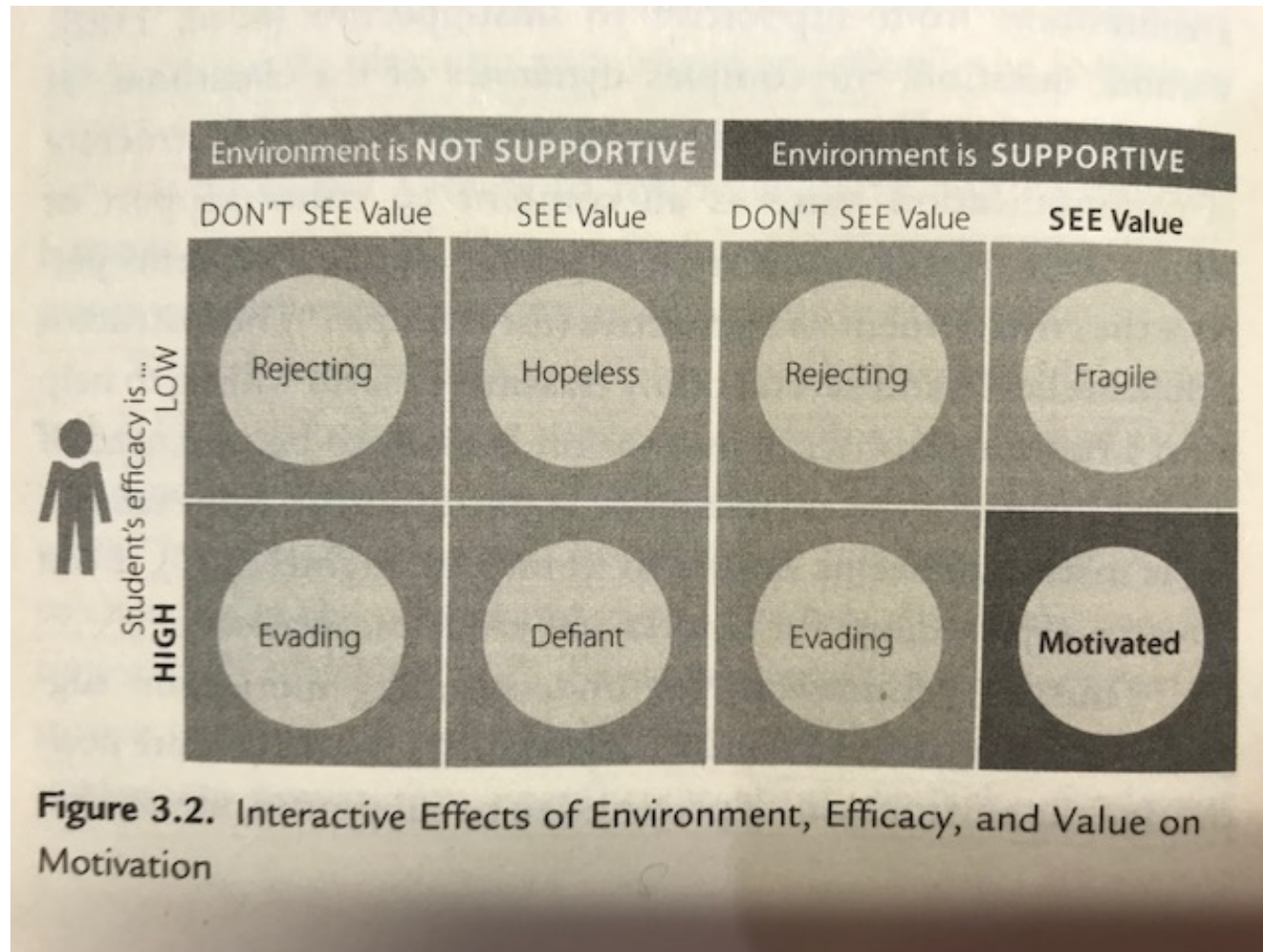- Understanding / knowledge of trainees

The GOBLET skills matrix for trainers

Challenge

- Try to reflect on your current skills and how they fit with this matrix
- Then share your thoughts with us
- goo.gl/18dcto

Motivation and demotivation

Figure 3.2. Interactive Effects of Environment, Efficacy, and Value on Motivation

Strategies to establish value

- Connect the material to students' interests

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- Identify an appropriate level of challenge

Strategies to establish value

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- Strategies for self-efficacy
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- Be fair
- Educate students about the ways we explain success and failure
- Describe effective study strategies
- Strategies for self-efficacy
- Provide flexibility and control
- Give students an opportunity to reflect

Things that an instructor shouldn't do in a course (from Carpentry Instructor Training)

- Tell learners they are rubbish because they use Excel and/or Word don't modularize their code, etc.

- Repeatedly make digs about Windows and praise Linux, e.g., say that the former is for amateurs.

- Criticise GUI applications (and by implication their users) and describe command-line tools as the One True Way.

- Dive into complex or detailed technical discussion with the one or two people in the audience who clearly don't actually need to be there.

- Pretend to know more than you do. People will actually trust you more if you are frank about the limitations of your knowledge, and will be more likely to ask questions and seek help.

- Use the J word ("just"). This signals the learner that the instructor thinks their problem is trivial and by extension that they therefore must be stupid for not being able to figure it out.

Examples of techniques that you can use to promote engagement in training

- Establish teamwork by agreement
- Introduce blended multi-media materials
- Make frequent use of instant feedback to monitor and to induce self-assessment
- Offer participatory stimuli (prizes, gamifications)
- Let learners doing recaps (in the morning about the day before, at the end of sessions, etc)
- Introduce physical exercise (e.g. at the beginning of after-lunch sessions): this is good for both physical and mental health
- Introduce short, relaxing breaks (e.g. one minute meditation)
- Assign tasks to groups (e.g. Python libraries) and let the groups present the result of their work

Activities and attitudes the instructor should keep to a minimum

- lecturing

- individual work out

- providing answers before letting participants doing it

- keeping the same pace for long time

- using a monotone modality of content delivery (including the tone of the voice)

- showing no enthusiasm

Activities and attitudes the instructor should promote

- **listening**
- questions asking
- challenging learners
- group discussions/brainstorming
- work in pairs/groups
- problem solving
- peer instruction (using sticky notes, see below Carpentry teaching practices)
- participants' interaction/neworking
- games
- physical exercise
- presentations by participants
- mode/pace/activity frequent change

Gamification

Using games in training may be an effective technique in many aspects.
Games promote:

- ice breaking
- interactivity
- networking
- fun
- pace discontinuity
- relax

The importance of…

Introductions and wrap-ups