Computer skills advanced creative problem solving

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- **Creativity and Problem solving**
  - Representations
- Problem solving and project management
  - Representations
- Computational thinking
- Algorithmic problem solving
  - Representations

Problems: etymology

- From Greek πρόβλημα (*próblēma*) = "obstacle", from the verb προβάλλω (*probállō*) = "put in front of", from the prefix προ- (*pro-*) = "in front" + βάλλω (*bállo*) = "put, throw".

- A **prob**l**em** is, generally speaking, an obstacle making difficult to reach an objective or satisfy a need, standing between the individual will and the objective reality.

- A problem is every situation or unsolved condition presenting difficulties in finding a solution.

Problem solving and creativity

- Also in creative activities the representation come after the analysis (or they often coincide)
- Among the techniques used to define a problem
  - Brainstorming (also used in project management)
  - Mental maps
  - Cause-effect diagrams
- They are ways to organize creativity
- Other techniques useful for the economic/financial or process/decisions/project fields are:
  - Deming cycle
  - 8D method
- Other common diagrams:
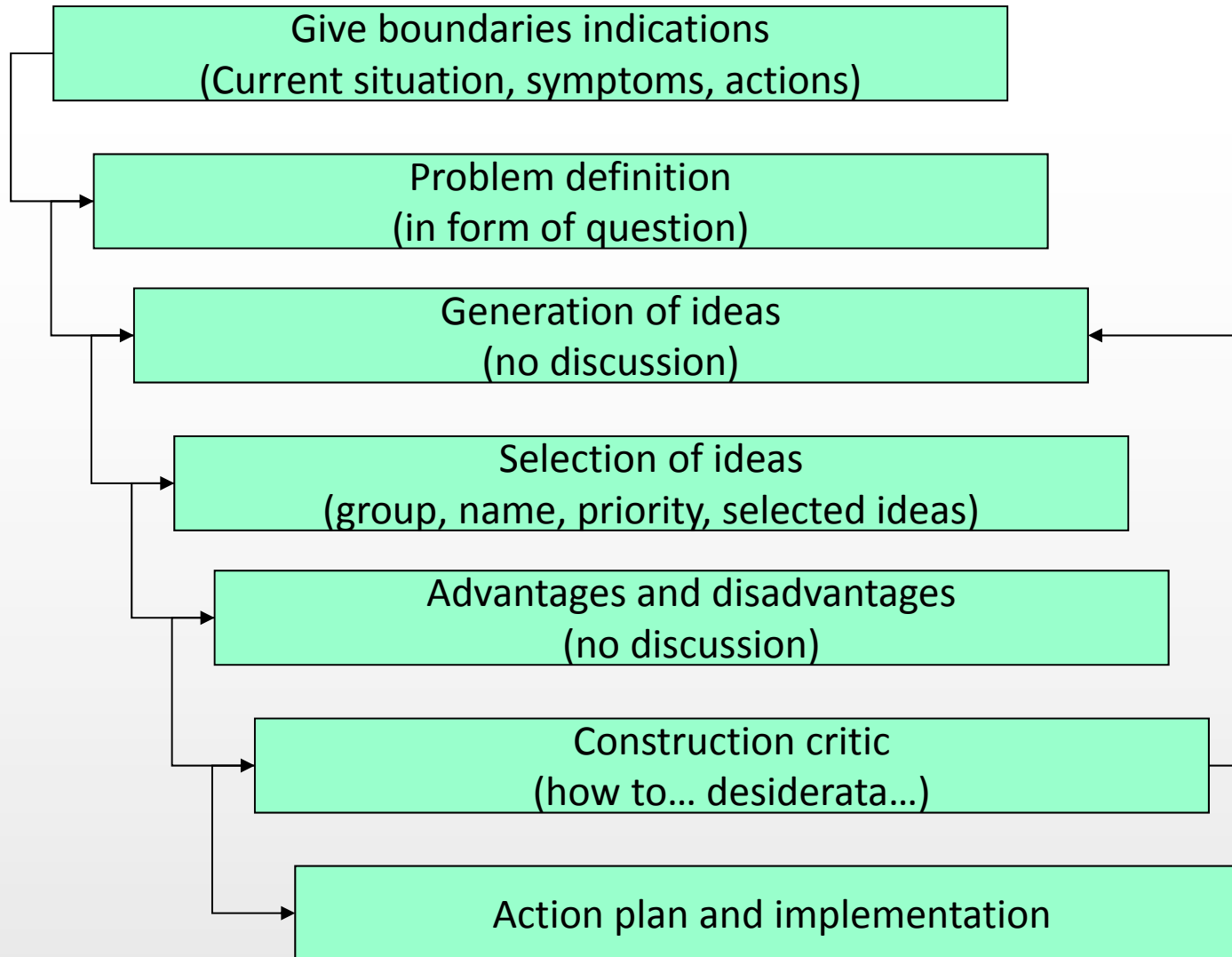 - Pyramid diagram
  - Onion diagram
  - Decision tree

Brainstorming

- It is a semi-structured group activity
- Often used to develop new ideas or to face a problem concerning innovation/improvement
- Group members are encouraged to freely express their ideas
- Collective intelligence
- 3 fundamental rules:
  - Participants are encouraged (no idea is stupid)
  - No judge on ideas before the end of the process
  - Each one must develop ideas of the others, generating combinations and exploring unexpected directions.

Brainstorming: the generic process

Give boundaries indications
(Current situation, symptoms, actions)

Problem definition
(in form of question)

Generation of ideas
(no discussion)

Selection of ideas
(group, name, priority, selected ideas)

Advantages and disadvantages
(no discussion)

Construction critic
(how to… desiderata…)

Action plan and implementation

Brainstorming: it fails when...

- Examples of brainstorming gone wrong:
- the session turns into a few people bickering, and the other participants saying nothing at all.
- good session, solid ideas, but no meeting notes or vague ones.

- Let's see some suggestions...

Brainstorming: quantity over quality

- Brainstorming is used in the first step in the exploration phase of a new project, so you have to collect as many as possible ideas, opportunities and threats, without any fear of rejection or judgment.

- Promote the production of ideas! (=many options)

Brainstorming: the «anchoring» problem

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- Often many people think brainstorming is just an open discussion in a meeting room with everyone involved. This is right, but sometimes the session become unproductive.

- For instance, when the first couple of ideas are shared during a session, there is a tendency to only focus on those ideas throughout the rest of the meeting.

- The biggest problem is that only a **few people do 60-75% of the talking**. This problem, called "anchoring", prevent fresh ideas from coming to light.

Brainstorming techniques: Brain writing

- Technique where idea generation is separated from discussion.
  - the team leader shares the topic
  - team members individually write down their ideas
- This eliminates the anchoring bias and encourages everyone to share their ideas (especially helpful for introverted participants).
- Individual brainstorming techniques, such as brain writing, will often give more unique ideas than when the group comes up with topic ideas together.

Brainstorming techniques: figuring storming

- Consist in considering how someone else (your boss, a famous celebrity, or even the president of the United States) might handle the situation or might say about a particular topic.

- Participants can put themselves in new shoes, obtaining a different perspective and, so, fresh ideas.

- It is an exercise that gives to the team several different viewpoint.

Brainstorming techniques: online brainstorming (brain-netting)

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- Virtual teams are currently very common. People often work remotely.

- Of course, ideas can be exchanged by email, but then it becomes difficult to archive those ideas for future reference. A **central location online** where team members can collaborate is crucial.

- Over the Internet, there are also a lot of great **brainstorming tools** supporting online brainstorming more of a visual and collaborative experience.

- An **online mind-mapping tool** (we'll see it in next slides) is very useful for virtual brainstorming.

Brainstorming techniques: rapid ideation

- Sometimes, putting a time limitations can help generate ideas quickly.
- With this technique, the team leader provides context with information or questions on the topic, budget, deadline, etc. Then, a time limit is set for individuals to write down as many thoughts or ideas around the topic as possible, using any available media and withoutfiltering their ideas.
- Media:
- pen and paper, white boards, Post-Its…
- Time limit can be from five to 45 minutes, depending on the complexity of your topic.

Brainstorming techniques: round robin

- Individuals form a circle.
- Once the topic is shared, go around the circle one-by-one and have each person offer an idea until everyone has had a turn.
- Simultaneously, a facilitator records all.
- Don't evaluate any ideas until everyone has the opportunity to share.
- This allows everyone to pitch in and contribute.
- Make sure to treat each idea with equal weight and to discourage people from saying "X already mentioned my idea."

Brainstorming techniques: starbursting

- This form of brainstorming focuses on forming questions rather than answers.
- The challenge consist in asking the team to come up with as many questions as they can about the topic.
- Start listing questions that deal with the who, what, where, when, and why (to address all the aspect of the project).
- Web oriented: this technique also eventually helps for a FAQ section for the project's website.

Brainstorming techniques: stepladder technique

- Every member in the team is encouraged to contribute individually before being influenced by everyone else.
- The facilitator shares the topic or question with the whole team.
- Then, everyone leaves the room except two members of the team, who will discuss the topic and their ideas.
- Then, one additional member is added to the group and he/she will contribute his/her ideas BEFORE the other two discuss theirs.
- Repeat this cycle until everyone from the original group is in the room.
- Stepladder incorporates both an individual and a group participation aspect. Useful for medium-sized groups of anywhere from five to 15 people.

Brainstorming techniques: tips…

- try putting on some brainstorm music. Depending on your company culture, or the team involved, the right kind of music at the right volume can help.
- Guidelines for picking music for productivity:
  - Keep it instrumental (it's better for concentration and attention)
  - Keep it in a major key (so the mood stays positive)
  - Ensure the music stays at a fixed tempo and volume (less distracting).

Brainstorming benefit

- So why is brainstorming in a group beneficial?
- It is a way to solve problems by holding a group discussion and collecting information or ideas that are arrived at via "unrestrained and spontaneous participation in discussion."
- It's a useful method to bring together a wide range of viewpoints.
- It's a quick way to generate a large quantity of ideas. A group effort can exponentially increase the number of ideas.

Brainstorming: other tips...

- Make the objectives crystal clear from the start. What is the problem about? What are the constraints?...

- Facilitate the session so that the people who are quiet have equal time to speak (not only people who tend to dominate discussions).

- Avoid anchoring by letting people generate ideas individually first, before coming together to discuss and elaborate.

- Go for quantity over quality at the start.

- Remember the central rule: no question or idea is stupid.

The mental maps

- Popular tool used for brainstorming and learning technique based on the visible organization of the ideas and of the interconnection among ideas
- It always starts from a problem or question positioned in the centre of the map
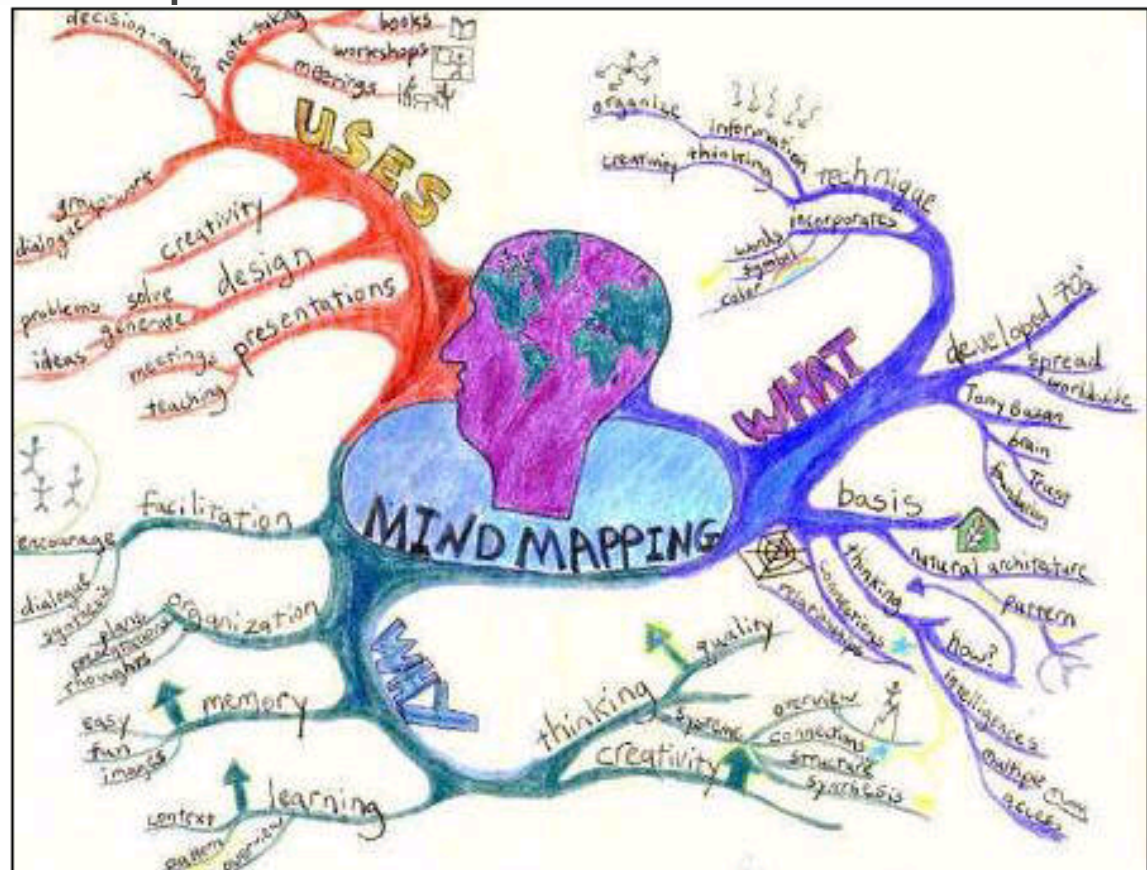
The mental map

- Many applications: communication, problem analysis, efficient presentations, learning
- Also useful to solve complex problems
- Many free software at disposition in the Internet

❑ Main ideas in the centre

❑ Preferable use images

❑ Use a large space (allowing to expand the map)

❑ Use colours and capital letters where it is useful

❑ Find relationships

❑ Detect secondary centres for secondary themes
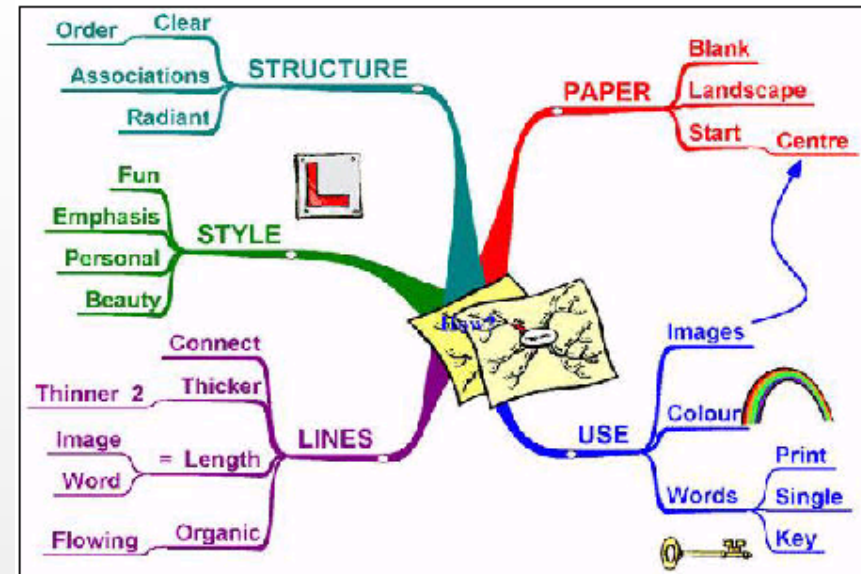
Online tools to create mental maps

- There are many tools
  - Both for local (on your PC) installation
  - And useful to create maps directly on line
- Totally free, or free for some features and with paying for the full version
- MindMeister: http://www.mindmeister.com/
- Mind42.com: http://www.mind42.com/
- Mindomo: http://www.mindomo.com/it/
- Maps of mind: https://mapsofmind.com/sandbox/
- Cmap (you need to download it): http://cmap.ihmc.us/download/

Tools on line for mental maps: **Maps of mind**

https://mapsofmind.com/sandbox/

Mental maps: abˈYl ℧a dˋY

Students' data analysis

•for example, we can use a mental map to organize students' data collected by different University offices

Students are grouped in Faculty, and consequently data must be organized in Faculty, too

For each student we will have several data (name, surname, and so on…

As told, mental map can be used both for express a concept or a problem and for organize data, representing a help in having a clear view of a problem (in this way we could decide, for example, what kind of tool is suited to analyse the data)

e-address:

Our first mental map

https://mapsofmind.com/sandbox/

- We will use *Maps of mind*, totally free, simple to use directly online, giving the possibility to save the map.

  Double click to create an InfoBox

  You can:
  change colours
  add links
  write text
  organize boxes

  Sign Up To Create and Save your own maps!

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