



Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

Fakulteta za energetiko

# Prenosljive spretnosti za doktorske študente: Orodja za reševanje problemov - konceptualne mape

doc. dr. Eva Klemenčič

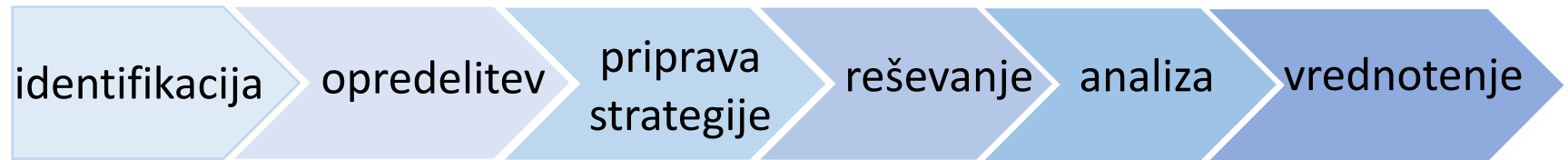
Maribor, 21. 6. 2024

*“Life is a continuous exercise in creative problem solving.”*  
 — Michael J. Gelb

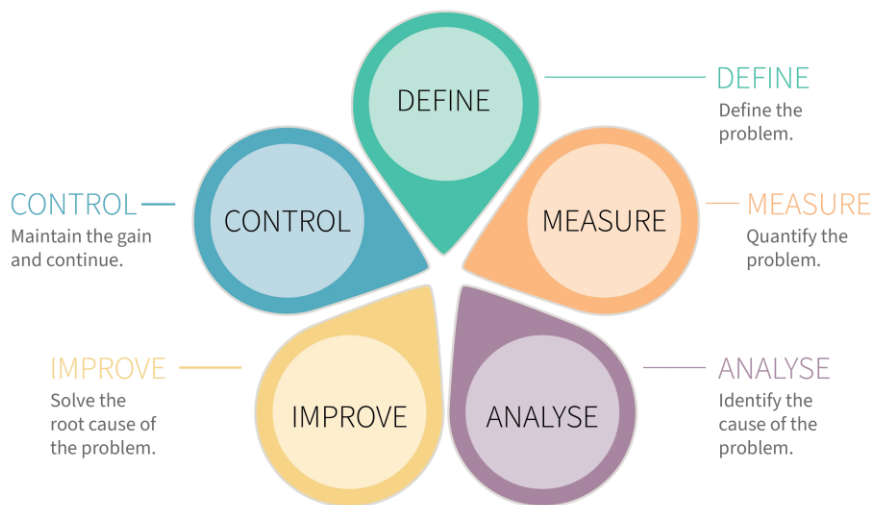
Q&A word cloud



# POSTOPEK REŠEVANJA PROBLEMOV

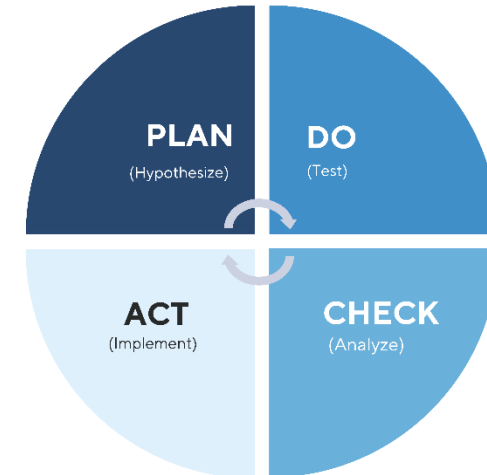


DMAIC



mutomorro  
change for good

PDCA

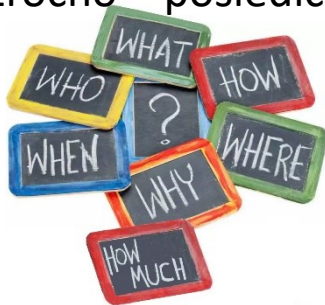


# METODE REŠEVANJA PROBLEMOV

identifikacija → opredelitev

- Osredotočiti na problem IN gledati širšo sliko
- Razčleniti problem na manjše dele
- Definirati posamezne dele problema
- Iskanje vzročno – posledičnih povezav

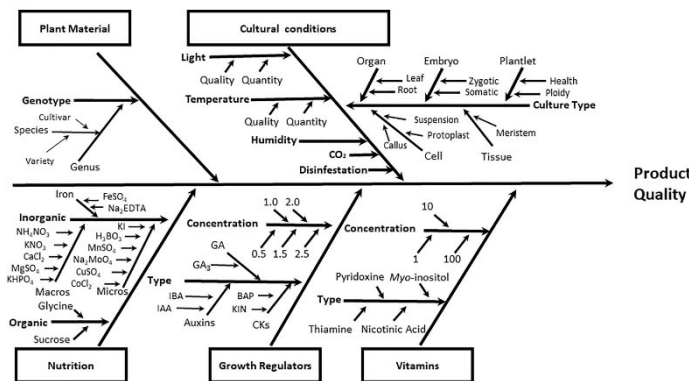
5W2H



Možganska nevihta „Brainstorming“

zapisovanje idej → vrednotenje idej

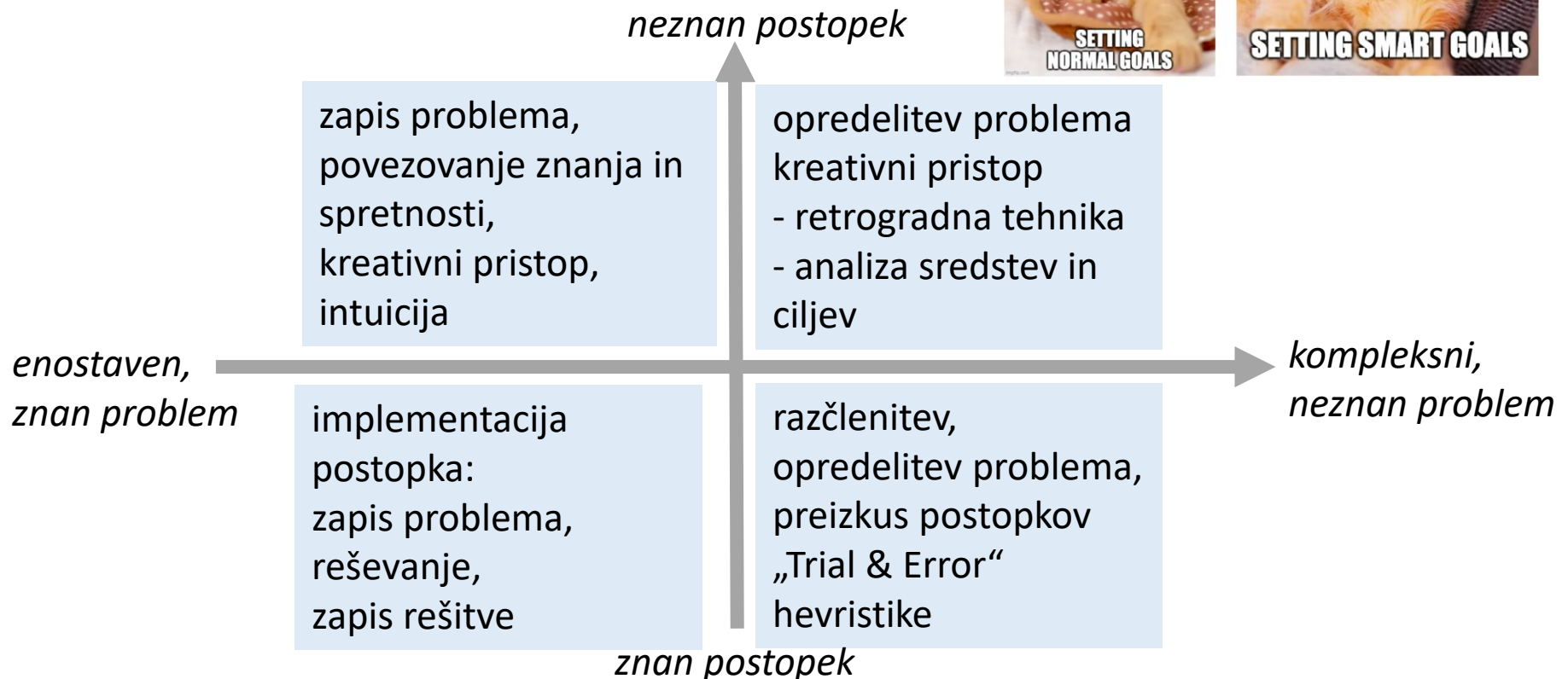
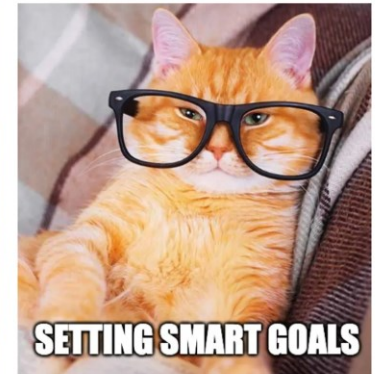
Diagram ribje kosti  
(Ishikava diagram)



# METODE REŠEVANJA PROBLEMOV



- Raziskati in preučiti obstoječe strategije reševanja
- Ustvariti novo strategijo reševanja



# METODE REŠEVANJA PROBLEMOV

identifikacija

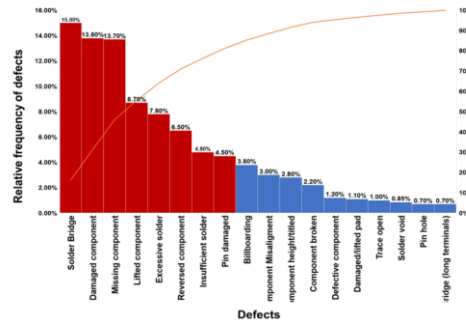
opredelitev

priprava  
strategije

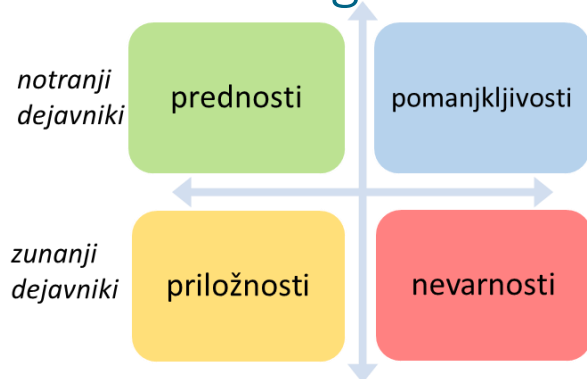
- Raziskati in preučiti obstoječe strategije reševanja
- Ustvariti novo strategijo reševanja

## PARETO analiza

- pravilo 80/20



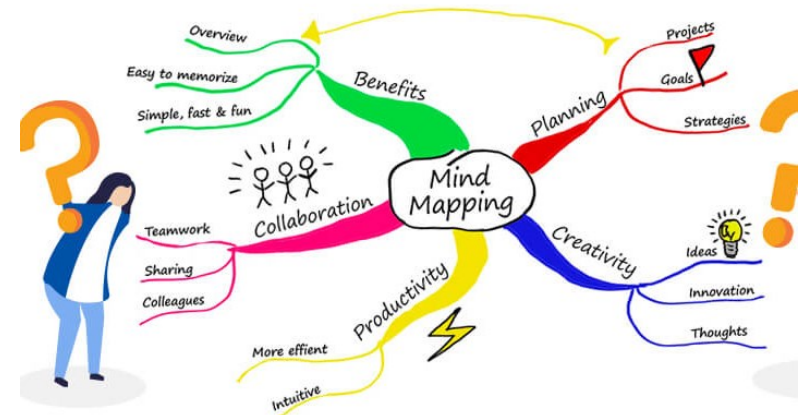
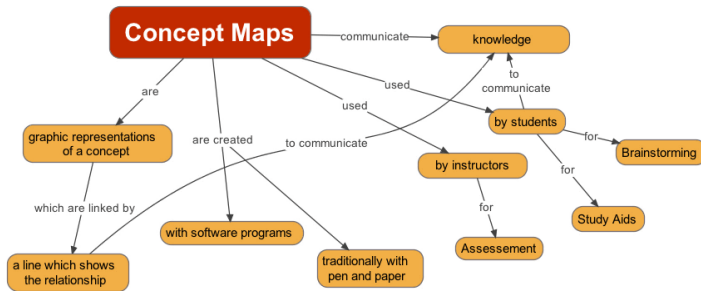
## SWOT: Strengths Weaknesses Opportunities Threats



# METODE REŠEVANJA PROBLEMOV



*Poznate ali prepoznate razlike med konceptualnimi in miselnimi mapami?*



**Katera trditev v največji meri opiše vaše stališče o konceptualnih mapah?**

Multiple Choice Poll 18 votes 18 participants

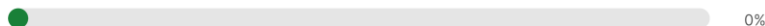
Konceptualnih map ne poznam. - 11 votes



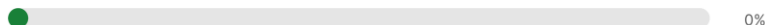
Konceptualne mape poznam, a jih ne uporabljam. - 7 votes



Konceptualne mape sem že uporabljal/a, a se mi ne zdijo učinkovito orodje (glede na rezultat, vložen čas, trud). - 0 votes



Konceptualne mape uporabljam. - 0 votes



**Katera trditev v največji meri opiše vaše stališče o miselnih mapah (vzorcih)?**

Multiple Choice Poll 16 votes 16 participants

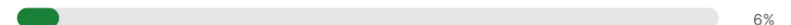
Miselnih map ne poznam. - 6 votes



Miselne mape poznam, a jih ne uporabljam. - 8 votes



Miselne mape sem že uporabljal/a, a se mi ne zdijo učinkovito orodje (glede na rezultat, vložen čas, trud). - 1 vote



Miselne mape uporabljam. - 1 vote

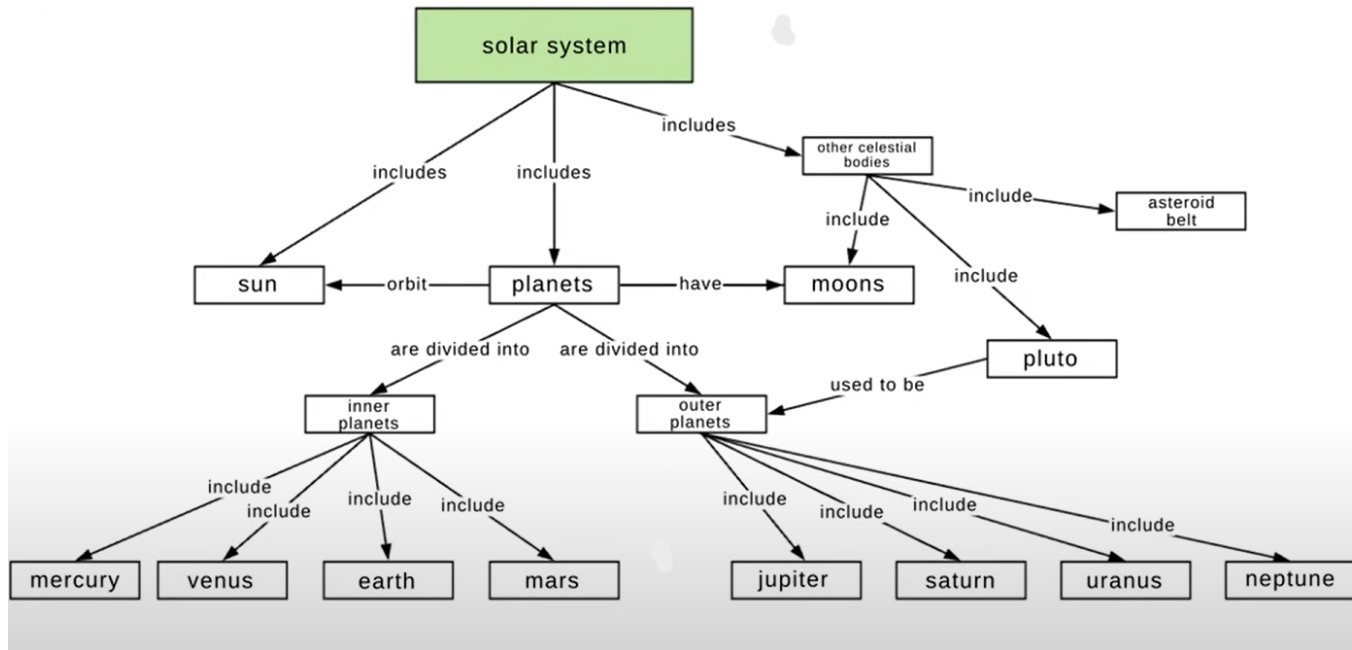




# KONCEPTUALNE MAPE

Kaj?

- Vizualna orodja za predstavitev in organizacijo znanja s ponazoritvijo odnosov med koncepti (hierarhična struktura)







# KONCEPTUALNE MAPE

## Zakaj?

- organizacija informacij,
- pomoč pri razumevanju konceptov in odnosov, analiza odnosov,
- vizualizacija relacij in analiza odnosov,
- prepoznavanje vzorcev,
- povezovanje interdisciplinarnih področij in prenos znanja,
- učenje, ponavljanje, utrjevanje in preverjanje znanja ...

Hay, David , Kinchin, Ian and Lygo-Baker, Simon(2008) 'Making learning visible: the role of concept mapping in higher education', *Studies in Higher Education*, 33: 3, 295 — 311

Sarker, P.K. (2015). Use of concept maps for problem-solving in engineering. *Australasian. Journal of Engineering Education*, 17, 29-33.

H Hidayati and R Ramli 2018 IOP Conf. Ser.: Mater. Sci. Eng. 335 012077

Doris, O. M. (2018). Effect of Concept Mapping in Teaching of Physics in Senior Secondary Schools in Portharcourt Local Government Area Rivers State. *European Scientific Journal, ESJ*, 14(31), 71.

Anju A.A, & Abhay M.. (2020). Concept mapping: a meaningful self-directed learning tool for problem based learning in physiology. *International Journal of Medical Science And Diagnosis Research*, 4(8).

Utami, B. et al. Implementation of Problem Solving with Concept Map to Improve Critical Thinking Skills and Chemistry Learning Achievement, *Proceedings of the International Conference on Teacher Training and Education 2017 (ICTTE 2017)*.



# KONCEPTUALNE MAPE

Kdaj? utrjevanje in preverjanje znanja

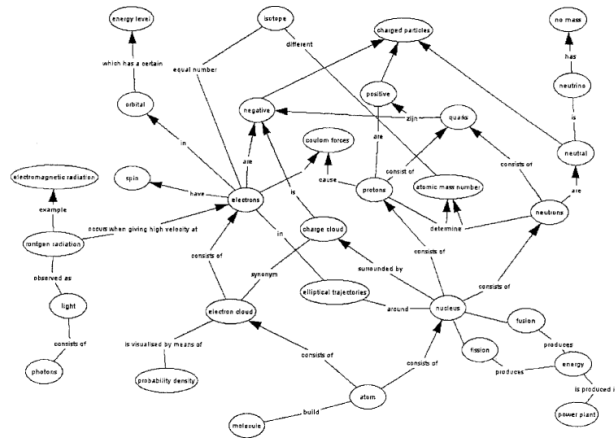
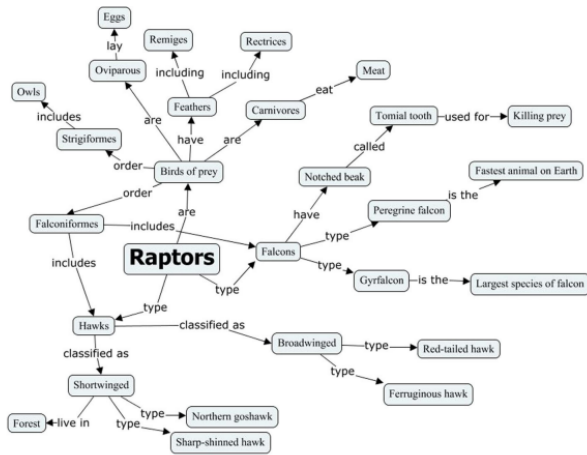


Figure 1. Example of a student's atom map.

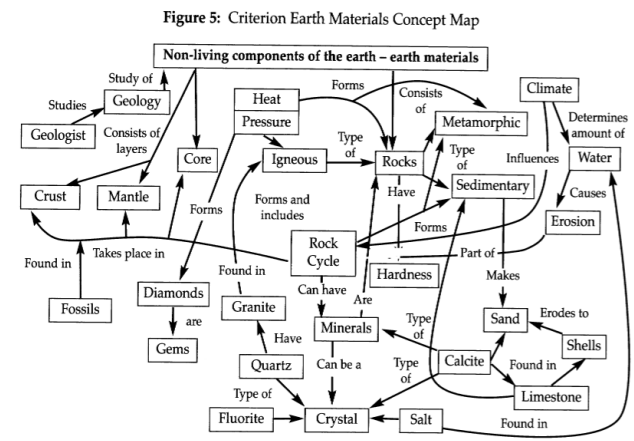


Figure 5: Criterion Earth Materials Concept Map

Fig. 1 Simple concept map about raptors. Note that this map is not meant to conform to any particular researcher's standards

Springer

NL Schroeder et al., Studying and Constructing Concept Maps: a Meta-Analysis. *Educ Psychol Rev* **30**, 431–455 (2018).

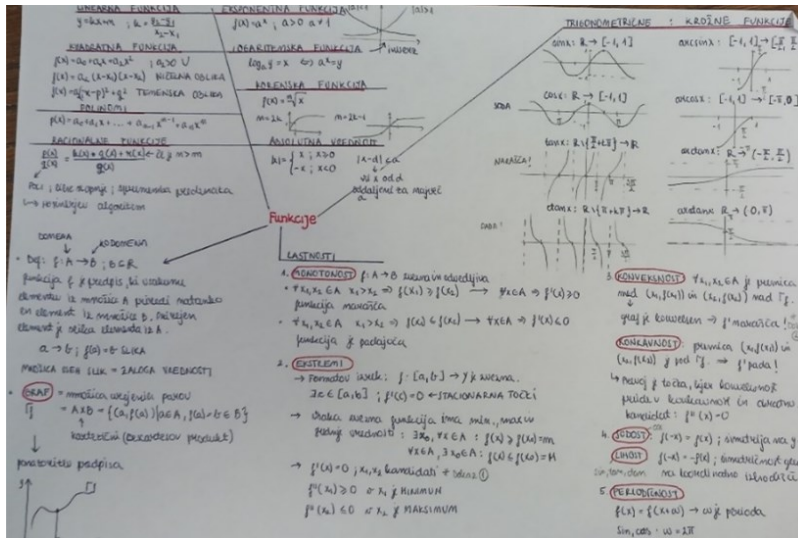
EV Zele et al., Improving the usefulness of concept maps as a research tool for science education, *Int. J. Sci. Educ.*, 26:9, 1043-1064 (2004)

R Zimmerman et al., The Use of Concept Maps in Facilitating Problem Solving in Earth Science. *Gift. Educ. Int.* 27(3), 274–287 (2011)



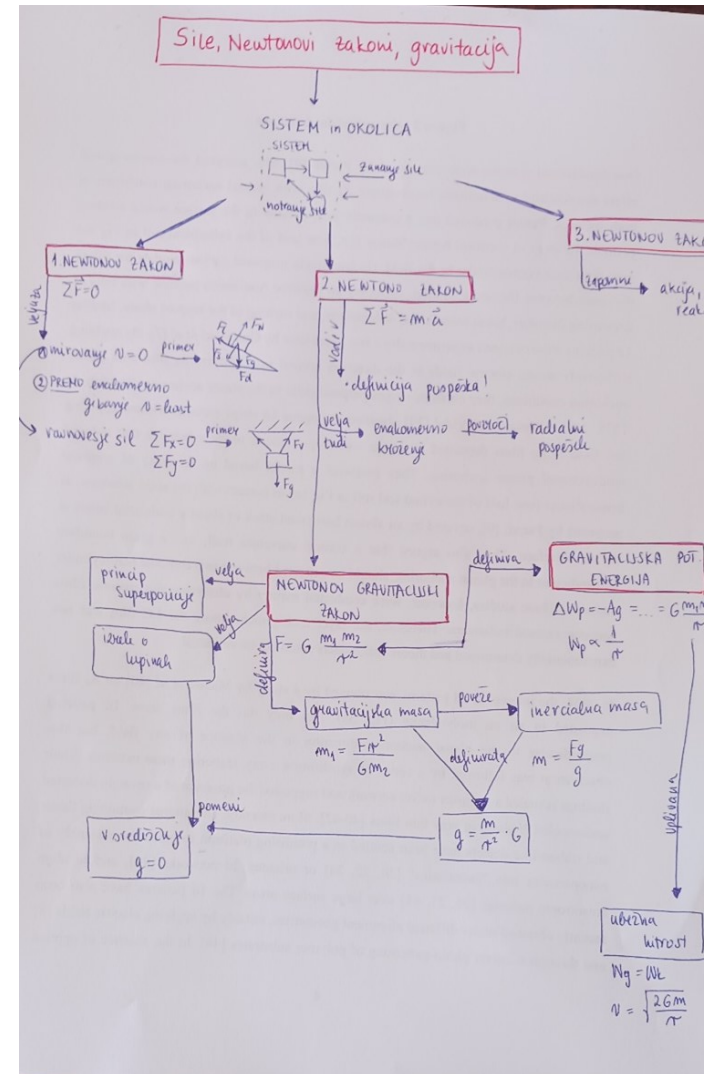
# KONCEPTUALNE MAPE

Kdaj? Organizacija informacij, aktivno učenje



Kako?

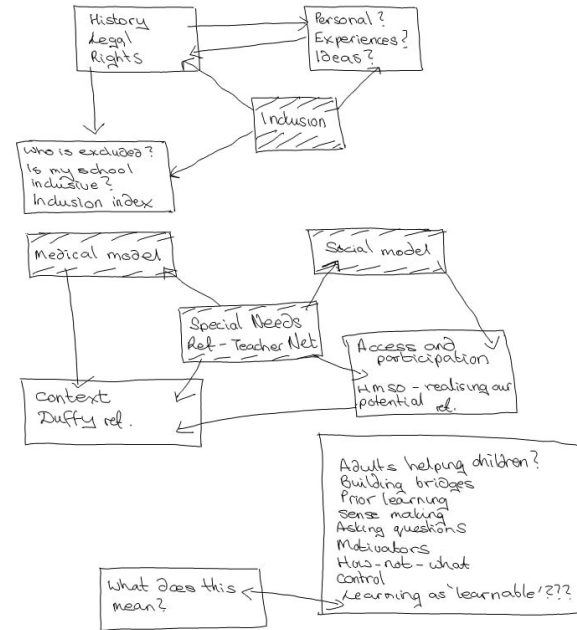
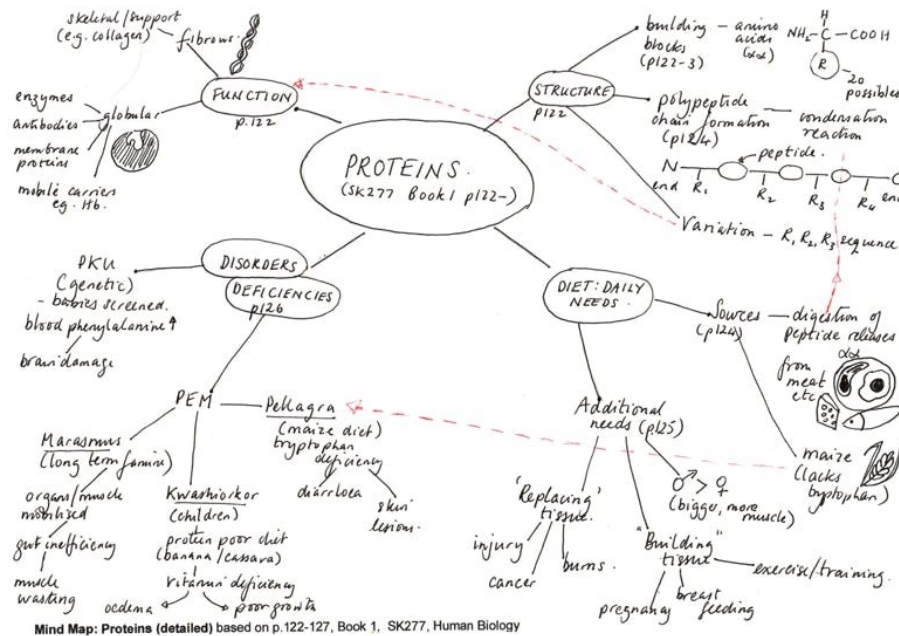
1. Določi glavno temo.
2. Organiziraj informacije v glavne kategorije/podteme.
3. Določi povezave in ustvari mapo (barve, skice ...)
4. Preglej mapo: kako so posamezni elementi povezani, več pojasni vse povezave, še najdeš kakšne?
5. Dopolnjud mapo z novim znanjem ➡ digitalna orodja





# KONCEPTUALNE MAPE

Kdaj? Spremljanje predavanj



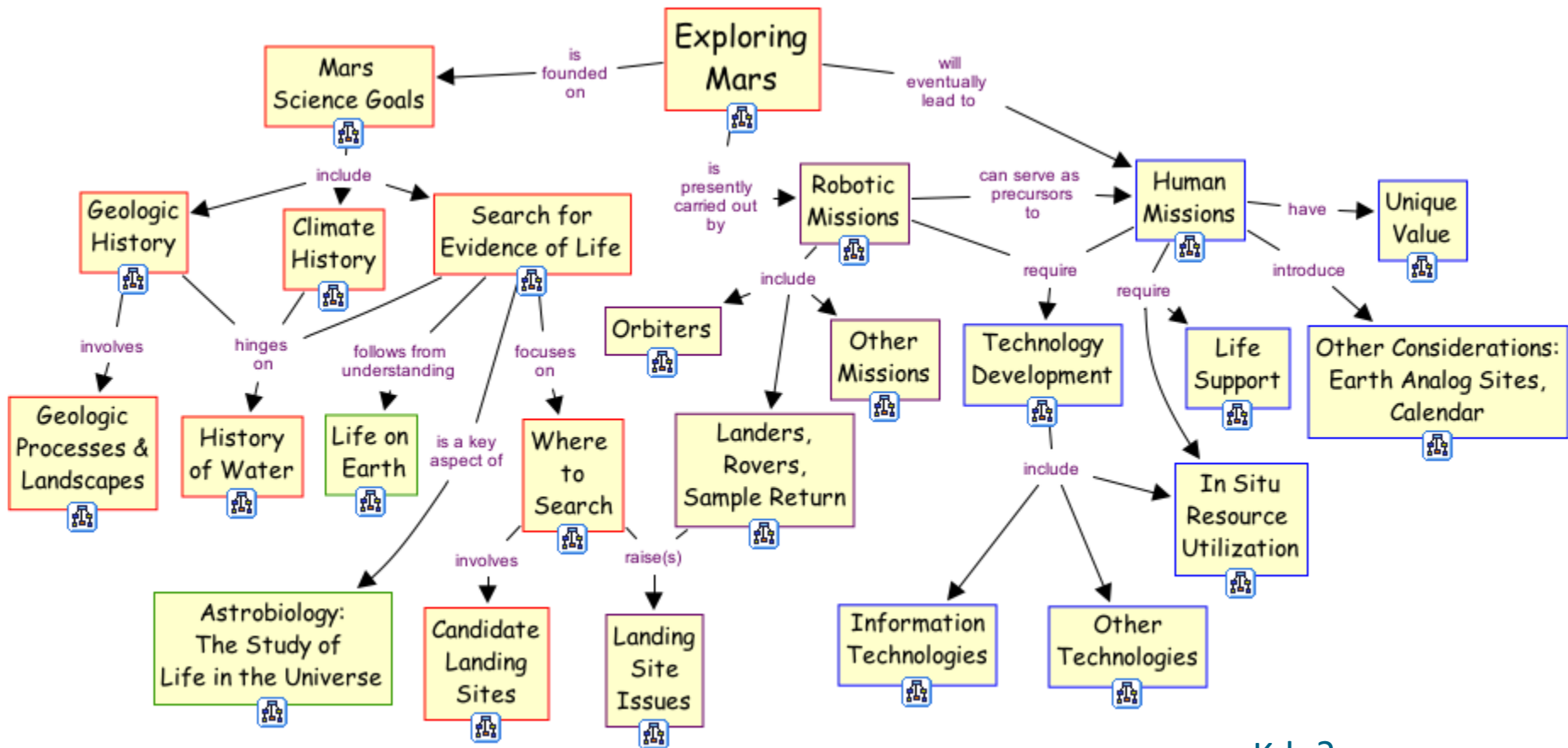
+ grafično orodje, vizualizira povezave, strukturira vsebino

- ločnica med dejstvi in mislimi, zahteva veliko koncentracijo



# KONCEPTUALNE MAPE

Kdaj? Načrtovanje dela, projekta



Kdo?  
Kje?  
Koliko?

# ORODJA ZA REŠEVANJE PROBLEMOV


- naštete metode
  - programska oprema (Matlab, Simulink, SPSS, Ansys, Azure Dev Tools ...), aplikacije
  - orodja za vodenje projektov, načrtovanje in timsko delo (MS Teams, Trello ...)
- Konceptualne mape  
MindMeister, Canva

**Overview**

A **concept map** is a diagram that shows connections between ideas.

**Let's Build our Concept Map**

Let's get started with the **numbered guides**.



**WHITBOARD ELEMENTS**  
Use these to create whiteboard magic! 😊

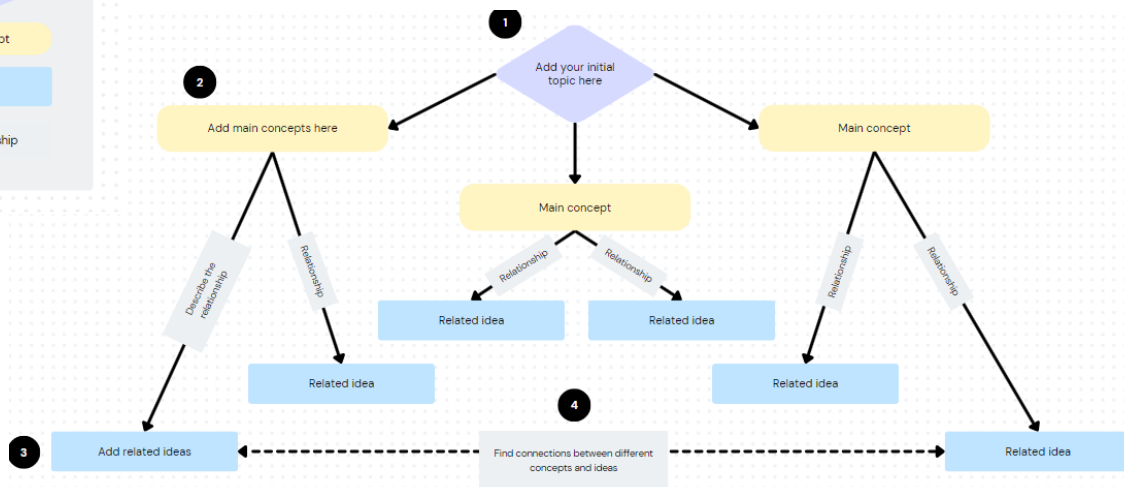
<p><b>STICKY NOTES</b></p> <div style="border: 1px solid green; background-color: #d9ead3; padding: 5px; margin-bottom: 5px;">Add Notes or Comments</div> <p><b>CONNECTORS</b></p> <p>→ → →</p> <p>← ← ←</p> <p>→ ← →</p>	<p><b>SHAPES</b></p> <div style="border: 1px solid purple; background-color: #d9ead3; padding: 5px; margin-bottom: 5px; text-align: center;">Topic</div> <div style="border: 1px solid orange; background-color: #d9ead3; padding: 5px; margin-bottom: 5px; text-align: center;">Concept</div> <div style="border: 1px solid blue; background-color: #d9ead3; padding: 5px; margin-bottom: 5px; text-align: center;">Idea</div> <div style="border: 1px solid gray; background-color: #d9ead3; padding: 5px; text-align: center;">Relationship</div>
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**Why Use It?**

- To simplify complex information
- To gain a big-picture understanding of the relationships between concepts
- To visually communicate a large amount of information

**When To Use?**

- Before starting a project
- Whenever there's a need to simplify or organize information
- For training or teaching purposes

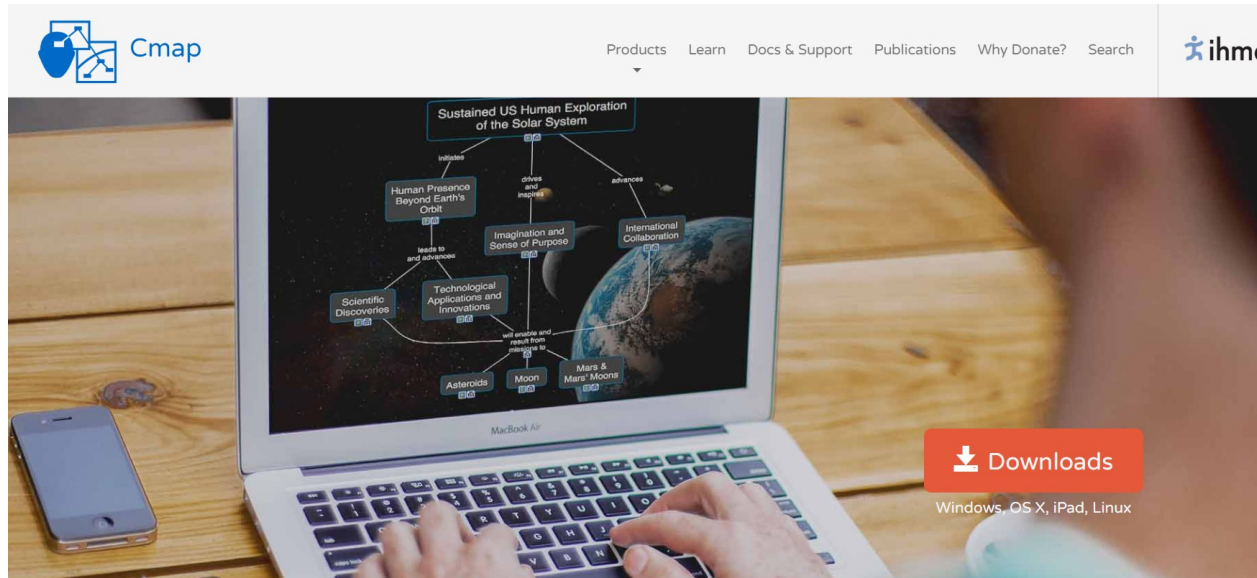




# ORODJA ZA REŠEVANJE PROBLEMOMV

- naštete metode
  - programska oprema (Matlab, Simulink, SPSS, Ansys, Azure Dev Tools ...), aplikacije
  - orodja za vodenje projektov, načrtovanje in timsko delo (MS Teams, Trello ...)
- Konceptualne mape

MindMeister, Canva, [Cmap](#), OneNote, WhiteBoard ... umetna inteligenca



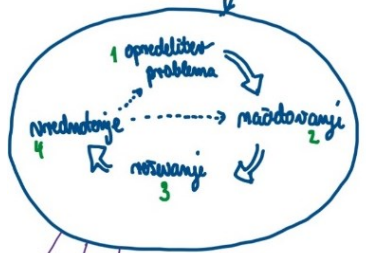
The screenshot displays the Cmap software interface. At the top, there is a navigation bar with links for 'Products', 'Learn', 'Docs & Support', 'Publications', 'Why Donate?', and 'Search', along with the 'ihmc' logo. The main content area shows a conceptual map on a laptop screen. The map is titled 'Sustained US Human Exploration of the Solar System' and features several interconnected nodes: 'Human Presence Beyond Earth's Orbit', 'Imagination and Sense of Purpose', 'International Collaboration', 'Scientific Discoveries', 'Technological Applications and Innovations', 'Asteroids', 'Moon', and 'Mars & Mars' Moons'. A 'Downloads' button is located in the bottom right corner of the image, with the text 'Windows, OS X, iPad, Linux' below it.

Cmap software is a result of research conducted at the Florida Institute for Human & Machine Cognition (IHMC). It empowers users to construct, navigate, share and criticize knowledge models

# ZAKLJUČEK

mašija → masovostne digitalne podjetnosti  
kompetenca 21. stol. → promagfirnost vizualizacija

**ORODJA ZA REŠEVANJE PROBLEMOV KONCEPTUALNE MAPE**



PDCA, DMAIC, RETRO GRAFNA tehnika

koj, kdo, kdaj, kje, kako, koliko, zakaj?



inner	strengths	weakness
outer	opportunities	threats

5W2H ? 1 ↔ se povezuje ↔ Brainstormin 1,2

drevesni diagram 1 ↔ razčlenitev ↔ rilja kost (Ishikawa) 1,2

5 x zakaj? 1,2 ↔ kvantificiramo ↔ PARETO analiza 1,2

SWOT analiza 1,2

podobnosti in kartile konceptualnih


- STRUKTURA**
  - hierarhična zgradba s križnim povezovanjem
- ELEMENTI**
  - koncepti
  - povezovalne frage - mostičjo odnose med koncepti
- NAMEN**
  - razumevanje kompleksnejših tem
  - raziskovanje odnosov med različnimi koncepti

## MISELNA MAPA

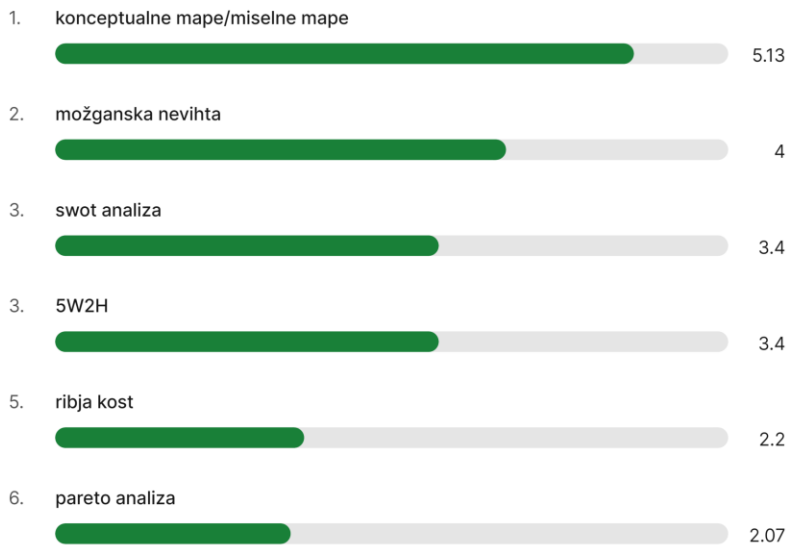
- STRUKTURA**
  - radialna zgradba
- ELEMENTI**
  - osrednja ideja - koncept
  - roje, podroje
  - različni elementi
- NAMEN**
  - gonitvanje idej, spodbujanje ustvarjalnosti
  - organizacija informacij



# ZAKLJUČEK

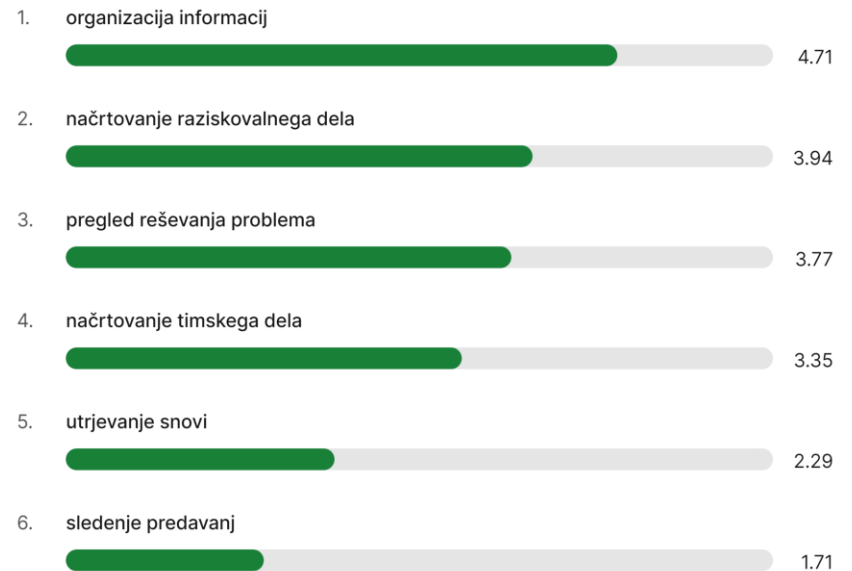
 Razvrstite metode, s katerimi ste se spoznali danes, od najbolj do najmanj uporabne za vaše raziskovalno delo.

Ranking Poll  15 votes  15 participants



Razvrstite, v kolikšni meri bi konceptualne mape uporabili za naslednje aktivnosti od najbolj do najmanj uporabne.

Ranking Poll  17 votes  17 participants



slido