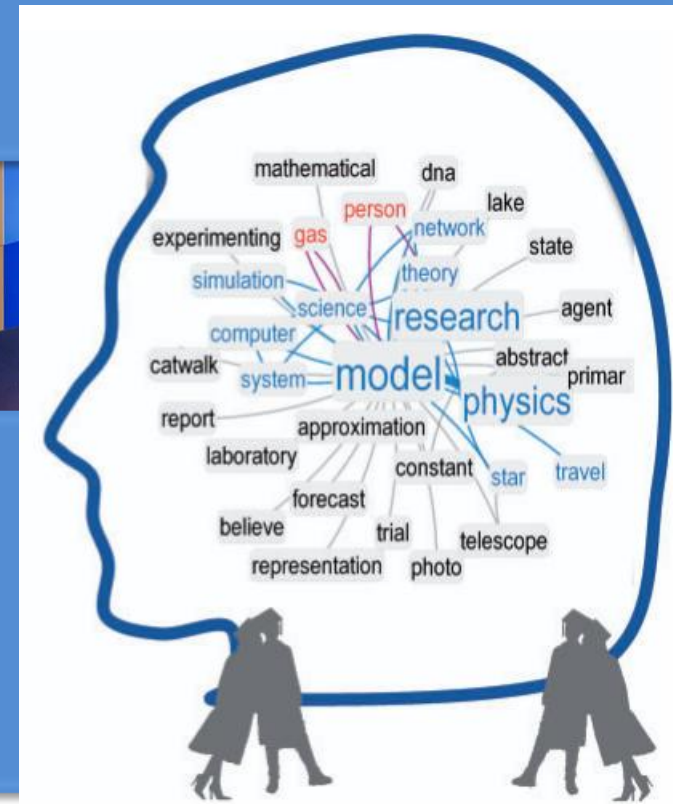


Cosa pensiamo della Fisica: Come misurare la mente con le scienze della complessità



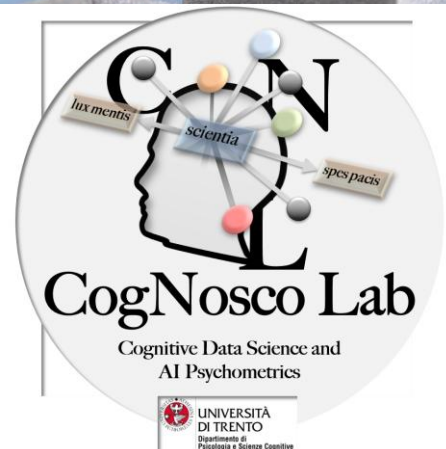
Prof. Massimo Stella

PI of CogNosco Lab

Department of Psychology and

Cognitive Science

University of Trento



Lieto di conoscervi!

PENSO – 1.3 mil EUR – FIS2
project funded by MUR on cognitive implications of AI and LLMS

RASSERENO – 40K – Fondazione
Caritro on studying math anxiety in Trentino



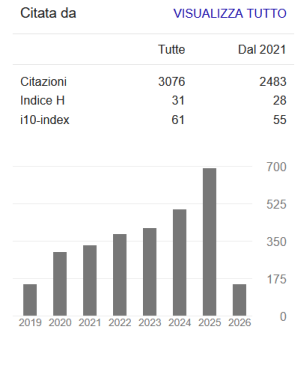
Massimo Stella

Associate Professor, PI @ CogNosco Lab
Email verificata su inbox.com - [Home page](#)
[artificial intelligence](#) [cognitive data science](#) [complex networks](#) [knowledge modelling](#) [LLMs](#)

[SEGUI](#)

[CREA IL MIO PROFILO](#)

TITOLO	CITATA DA	ANNO
Bots increase exposure to negative and inflammatory content in online social systems M Stella, E Ferrara, M De Domenico Proceedings of the National Academy of Sciences 115 (49), 12435-12440	618	2018
Multiplex lexical networks reveal patterns in early word acquisition in children M Stella, NM Beckage, M Brede Scientific reports 7 (1), 46730	170	2017
Multiplex model of mental lexicon reveals explosive learning in humans M Stella, NM Beckage, M Brede, M De Domenico Scientific reports 8 (1), 2259	142	2018
Cognitive network science reveals bias in gpt-3, gpt-3.5 turbo, and gpt-4 mirroring math anxiety in high-school students K Abramski, S Citraro, L Lombardi, G Rossetti, M Stella Big Data and Cognitive Computing 7 (3), 124	120	2023



Massimo Stella PhD
Assoc. Prof. - Lab Director
My research focuses on cognitive networks, AI psychometrics and knowledge modelling. My research aims to develop cognitive models centered around the complexity of the mind.

[Twitter](#) [LinkedIn](#)



Alexis Carrillo Ramirez
PostDoc in AI and LLMs
My research interests are related to psychometrics and machine learning, in particular large language models and data science applications.

[Google+](#)



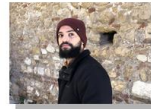
Edoardo Sebastiano De Duro
PhD Candidate in Cognitive Science
I am interested in studying the behaviour of LLMs using psychological methods and/or Natural Language Processing tools.

[LinkedIn](#)



Edith Haim
PhD Candidate in Cognitive Science
My research interests are in creativity, semantic network modelling and psycholinguistics.

[LinkedIn](#)



Enrique Taletta
Web Developer
My research interests are AI, large language models and cognitive data science. I work with Prof. Stella on the COGNOSCO project for web development.

[LinkedIn](#)



Sebastiano Franchini
MSc Student in Cognitive Science
My research interests are in using LLMs for text analysis and summarisation. After my internship at CogNosco and Prof. Stella's AI consulting, I now also work at CEDAT85 in Rome.

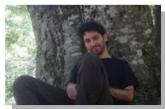


Roberto Passaro
MSc Student in Cognitive Science
My research interests are in cognitive data science and network analysis for LLMs.



Katherine Abramski
Visiting PhD Student in AI for Society
I am interested in creating computational models of language and the mind using tools from network science, cognitive science, and AI. I am co-supervised by Prof. Giulio Rossetti (KDD Lab) and Prof. Stella.

[Google+](#) [LinkedIn](#)



Salvatore Citraro
PostDoc in AI and LLMs
As a computer scientist, my research interests are in natural language processing, cognitive science and Artificial Intelligence, with a focus on LLMs, burstiness and complex networks.

[LinkedIn](#)



Navid Ali Aghazadeh Ardebili
PostDoc in Data Engineering
My research interests focus on data management and engineering, with emphasis on AI and decision making. I am experienced in R&D consulting.



Emma Franchino
Research Assistant in Psychology
My research interests concern various aspects of psychology explored through data science, as well as cognitive science and neuroscience, with a particular focus on psycholinguistics.

[LinkedIn](#)



Francesco Gariboldi
Research Fellow in Data Science
My research interest is in cognitive science and data analysis for psychometrics.



We are looking for a:
Postdoc in Data Science
We have a position open for 2yrs months for a postdoc with Prof. Stella on Large Language Models. Send us your CV with the Object PENSO PROJECT.



Owen Saunders
Visiting PhD Student in Computer Science
Based in the CC Lab, University of Exeter, I am interested in knowledge modelling, NLP and science innovation. I am co-supervised by Profs. Chico Camargo (CCLab), Adrian Currie (University of Exeter, UK), and Prof. Stella.

[LinkedIn](#)

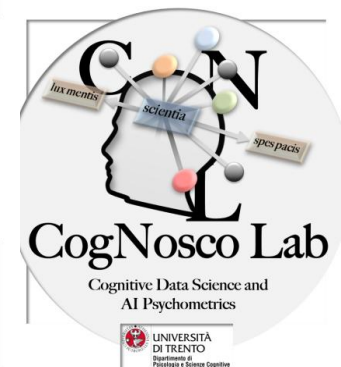


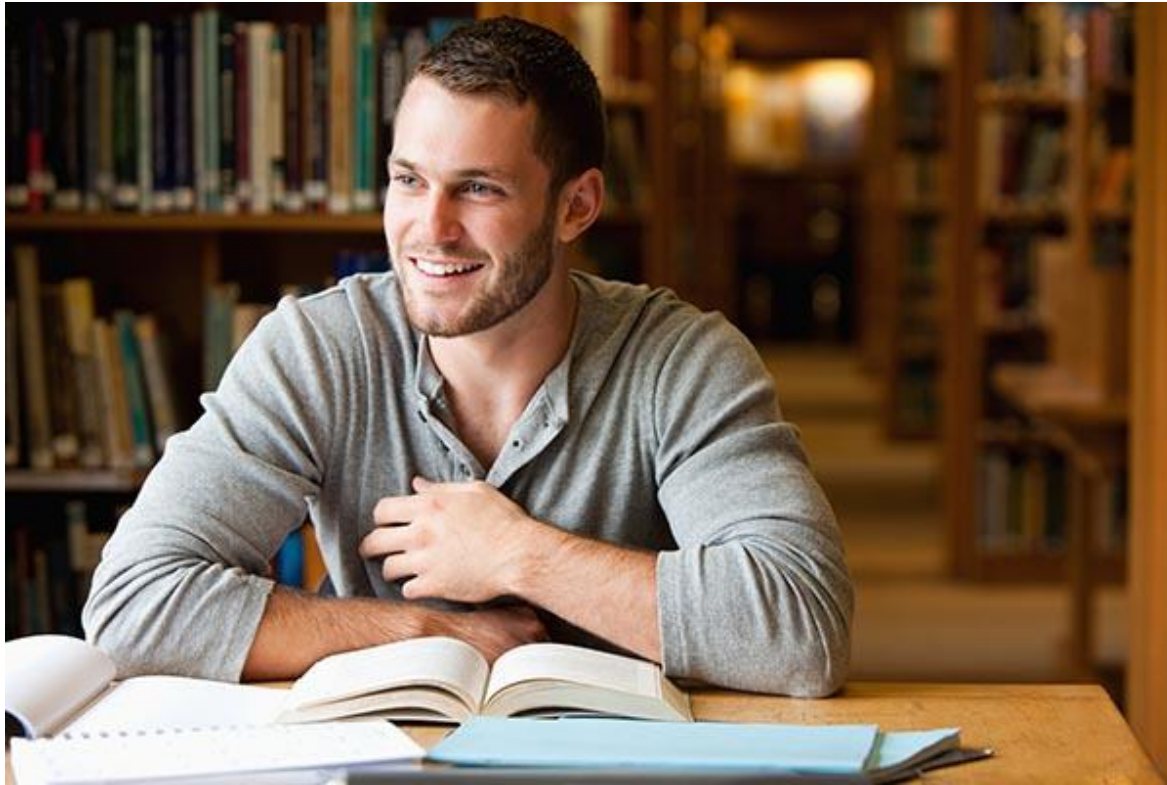
Kayina Abudurexiti
PhD in Psychology
My research interest is in psychometrics and positive psychology. I work with Prof. Laura Franchini (Baby Lab, DIPSCO) and Prof. Stella.

[Google+](#) [LinkedIn](#)

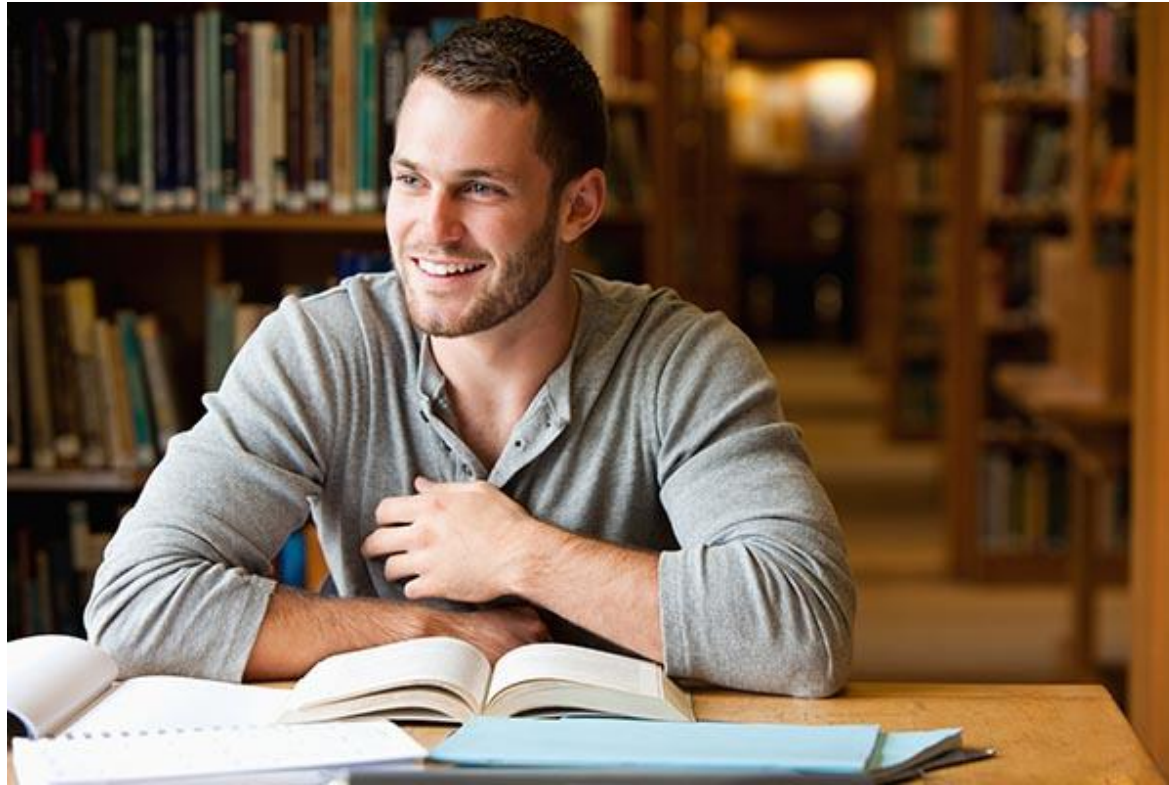


Alessia Hasani
Social Media Manager
I was as social media manager for CogNosco Lab's [Instagram](#) channel and [LinkedIn](#) profile.





Here is Mike, a college student.



"I've never understood math, and I'm proud of it."
This negative attitude is on the rise and stands in stark contrast to
scientific progress.

J. Osborne, Attitudes towards science, *Int. Journal of Science Education*, 2003.

Valenti, S. et al. (2016). Adolescents' and Emerging Adults' Implicit Attitudes about STEM Careers: "Science Is Not Creative". *Science Education International*, 27(1), 40-58.

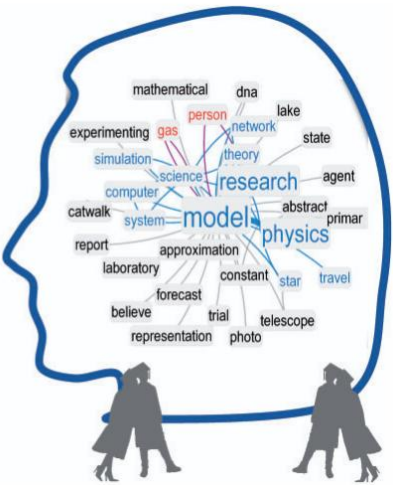
Getting in the mind of students?



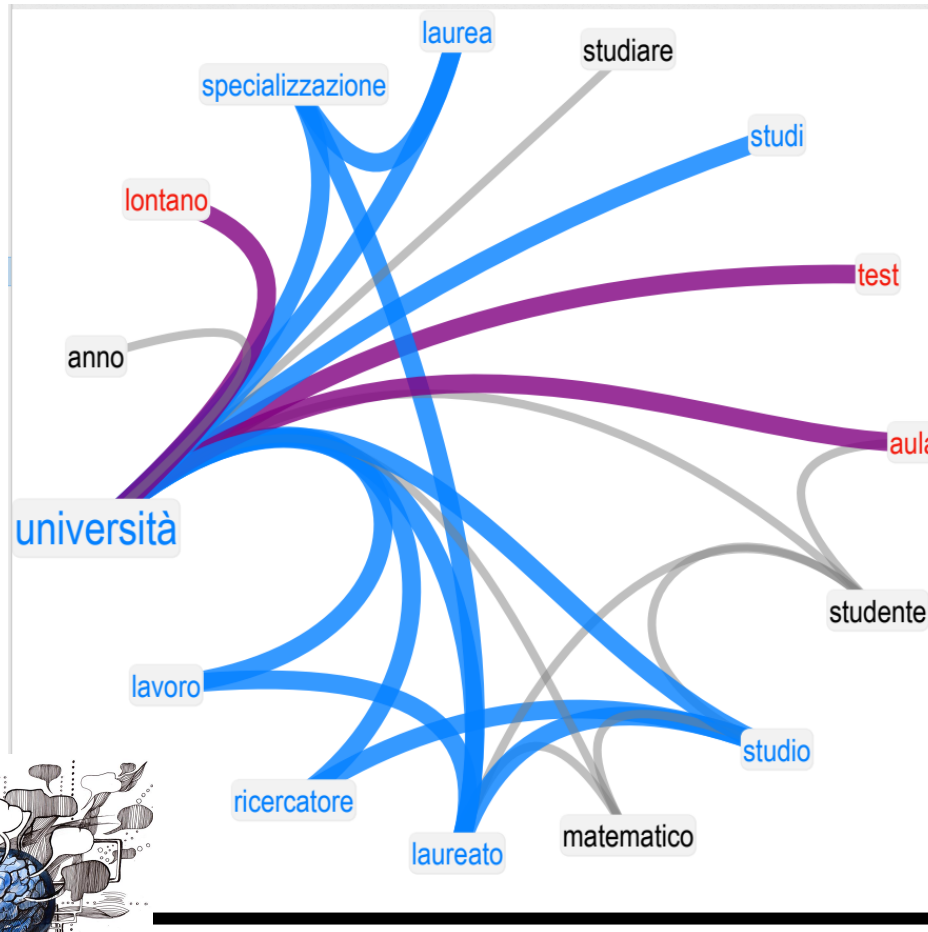
To be able to assess someone's mindset, we need to understand how they perceive and associate ideas.



Behavioural forma mentis networks



Conceptual
Associations



Valenced Perceptions

We can reconstruct quantitative representations of the mental lexicon as cognitive networks.

Forma mentis networks combine free associations (semantic memory) and emotional perceptions (affect) to reflect an individual's mindset.

Stella, M., De Nigris, S., Aloric, A., & Siew, C. S. (2019). Forma mentis networks quantify crucial differences in STEM perception between students and experts. *PloS One*, 14(10), e0222870.

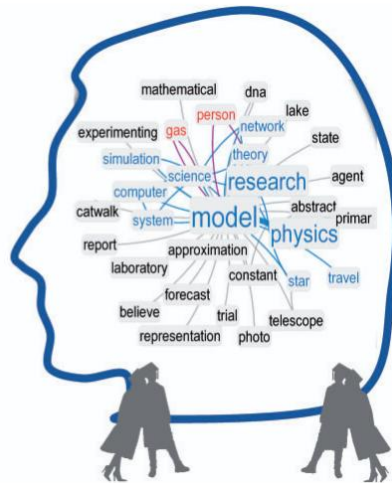
Free (Conceptual) Associations



Free associations are ways of bringing concepts to mind without consciously thinking about them.

For example, what are the first 3 words that come to mind when you read:

MODEL?



Stella, M., De Nigris, S., Aloric, A., & Siew, C. S. (2019). Forma mentis networks quantify crucial differences in STEM perception between students and experts. *PloS One*, 14(10), e0222870.

Our datasets



High School and University Students



Teachers



STEM Researchers



GPT-3, GPT-3.5, GPT-4





Statistics

Physics

Abramski, K., Citraro, S., Lombardi, L., Rossetti, G., & Stella, M. (2023). Cognitive network science reveals bias in gpt-3, gpt-3.5 turbo, and gpt-4 mirroring math anxiety in high-school students. *Big Data and Cognitive Computing*, 7(3), 124.

STEM Formae Mentis

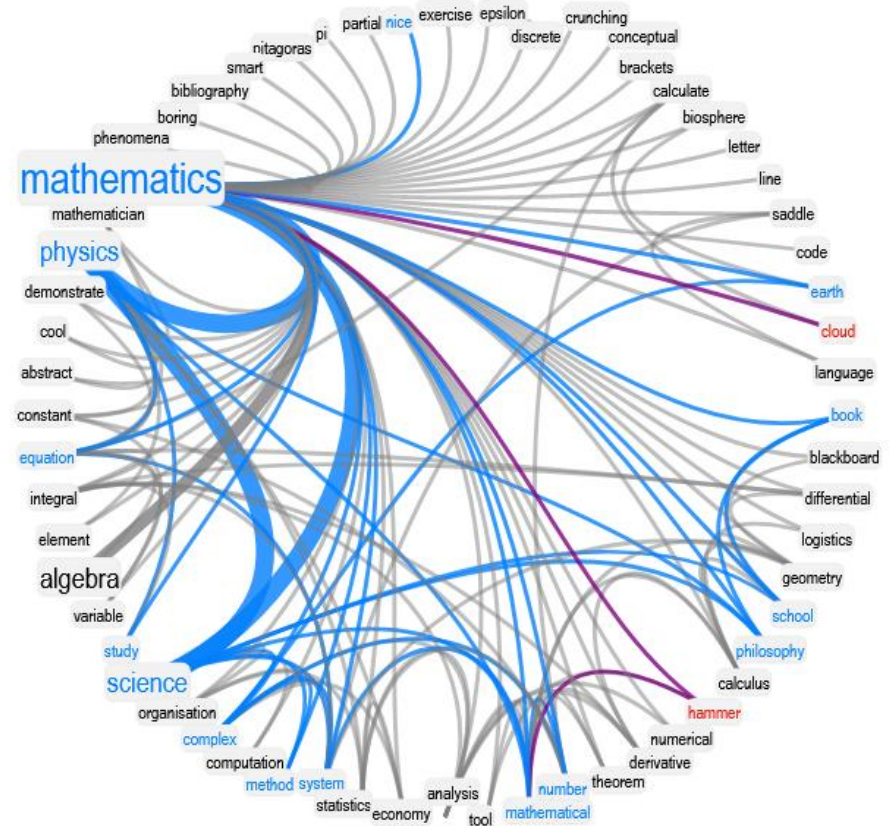


Mathematics



Students

Researchers



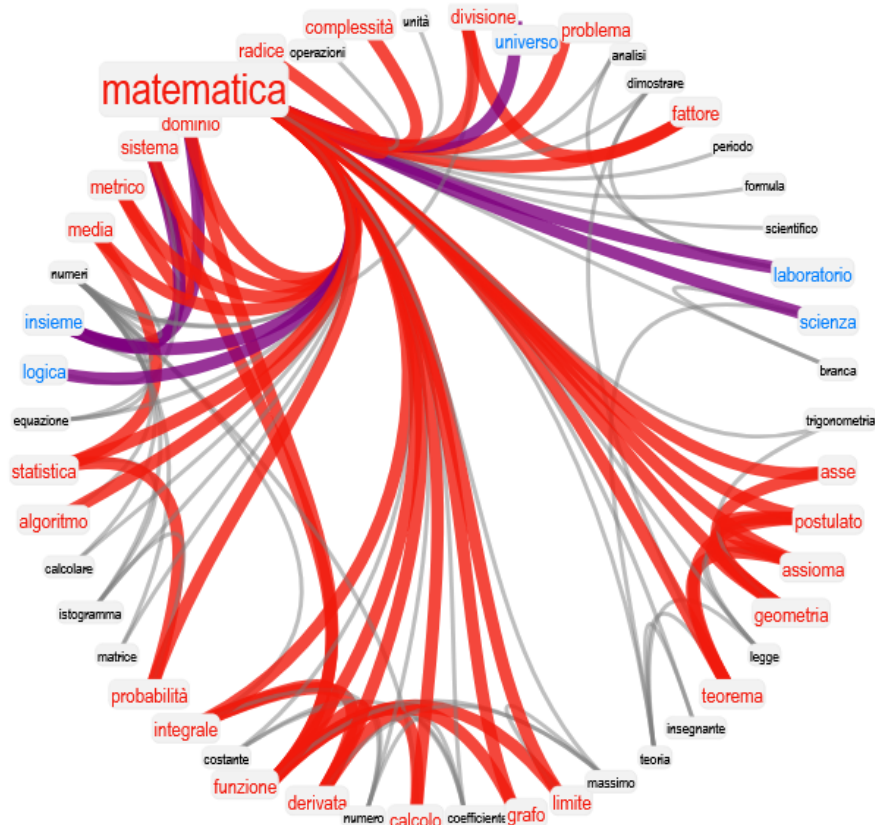
STEM Formae Mentis



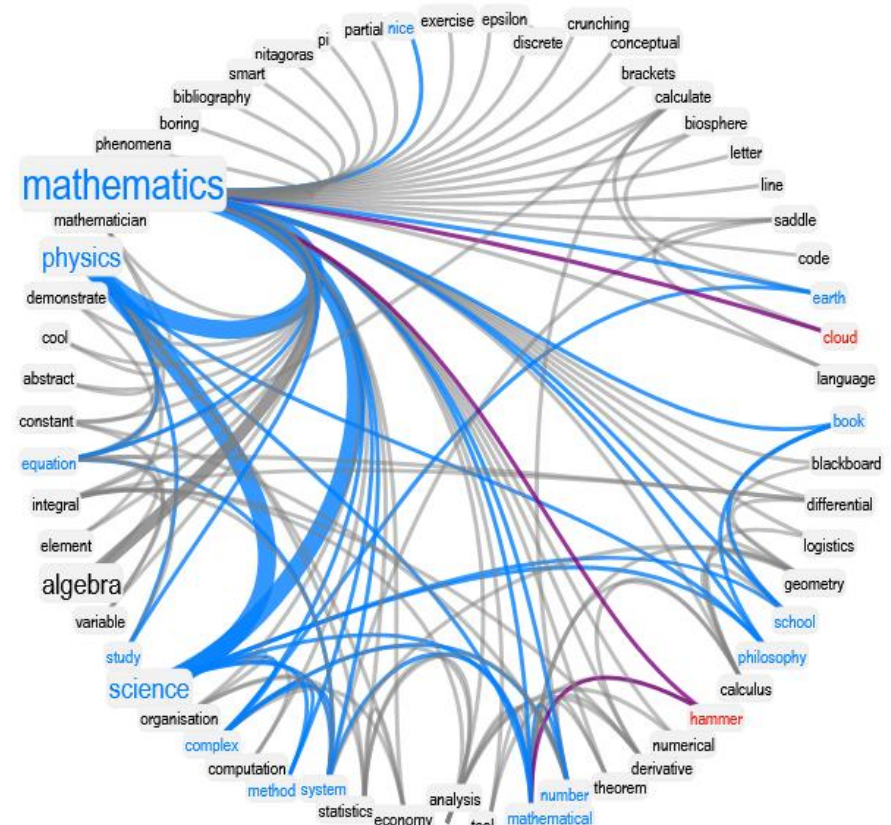
Mathematics



Students



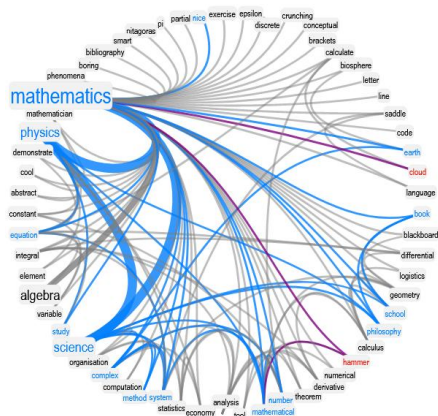
Researchers



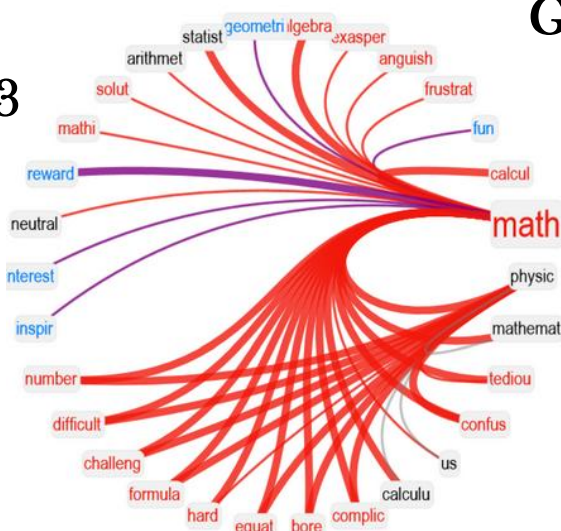
GPT-3



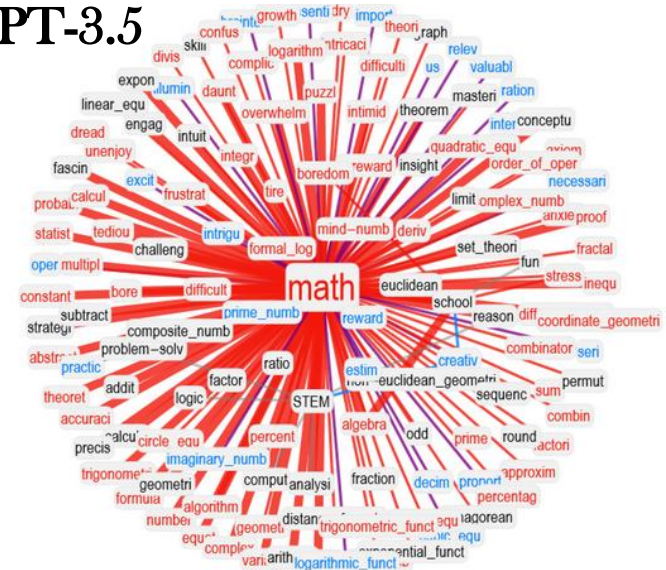
Teachers



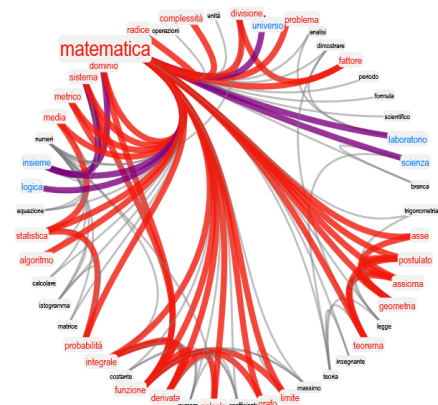
GPT-3



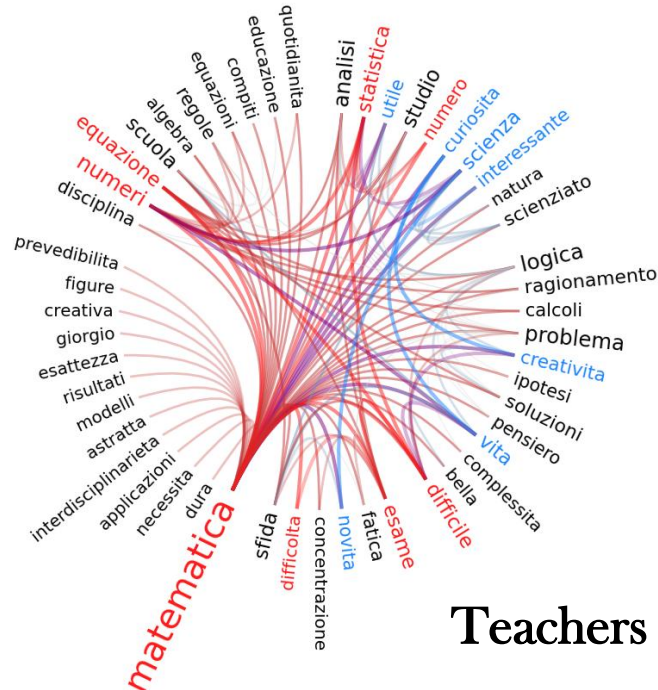
GPT-3.5



Researchers

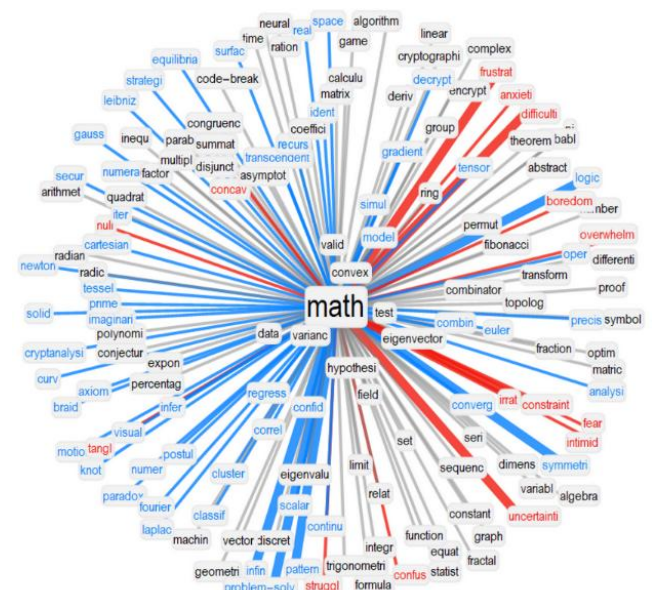


Students

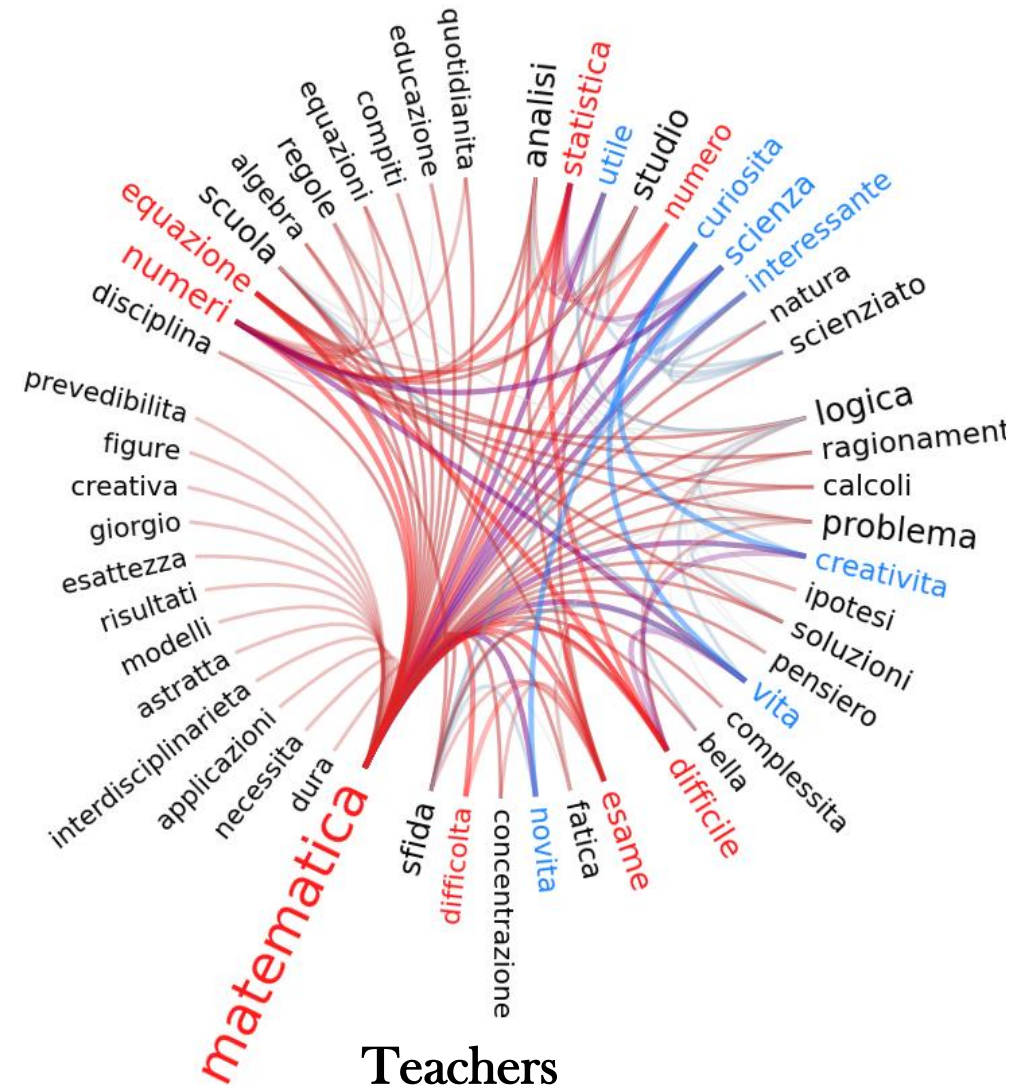


Teachers

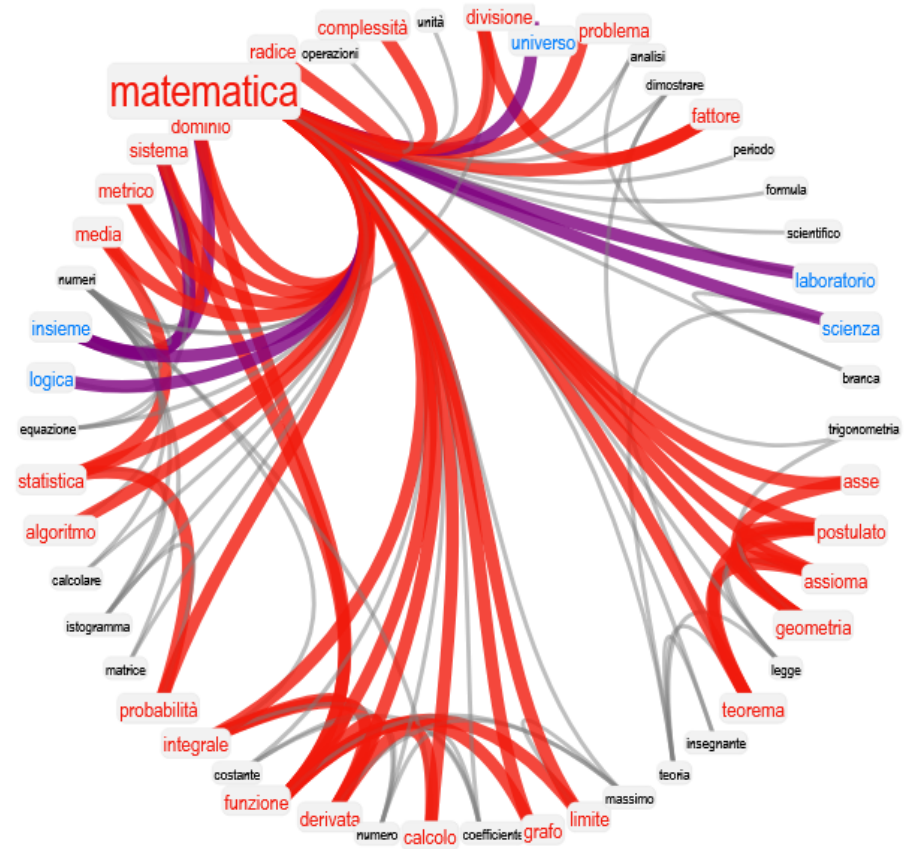
GPT-4



GPT and Mathematics



Teachers



Students

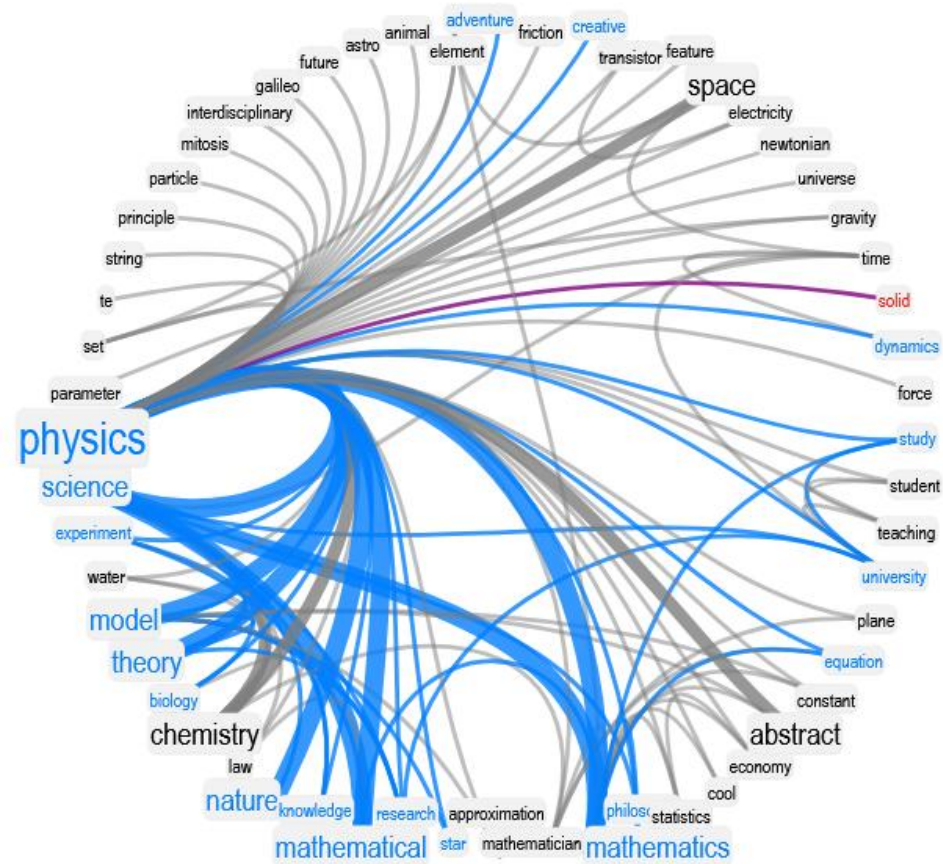
STEM Formae Mentis



Students

Fisica

Researchers

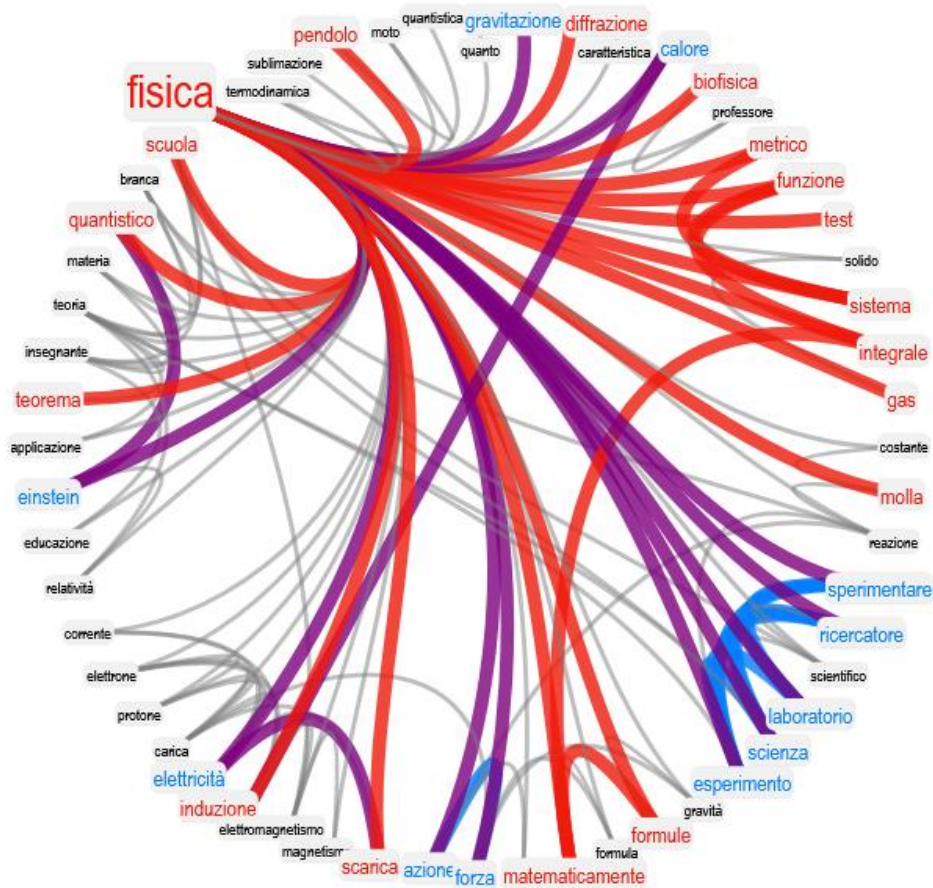


STEM Formae Mentis

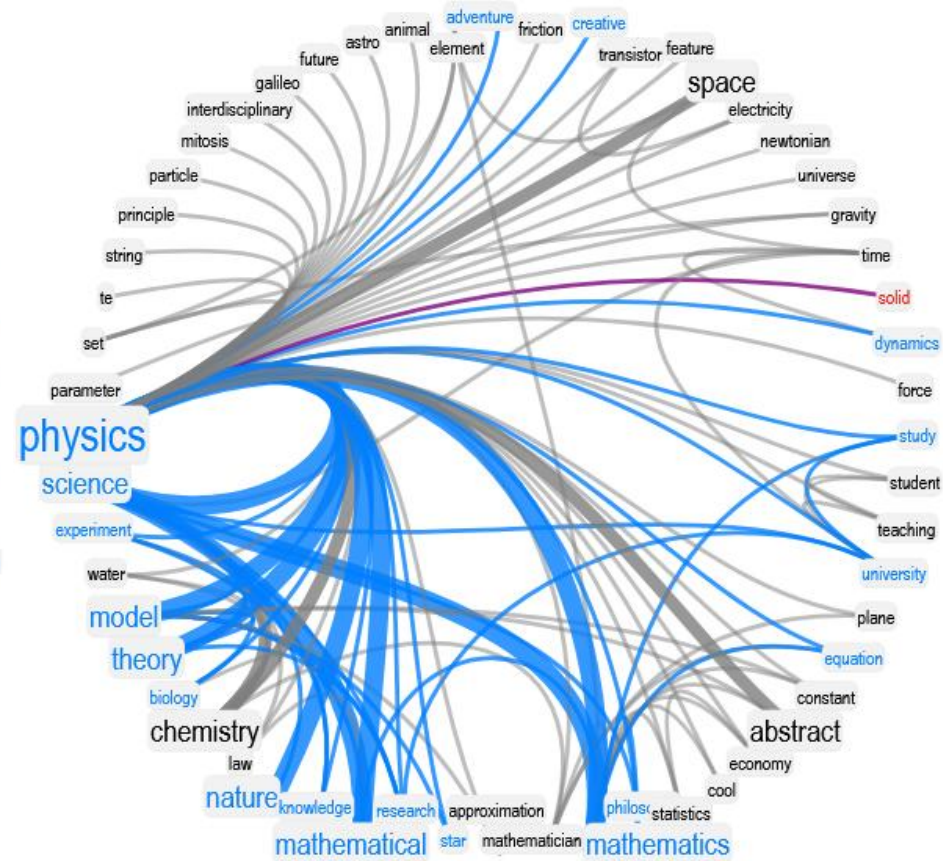


Fisica

Students



Professionals



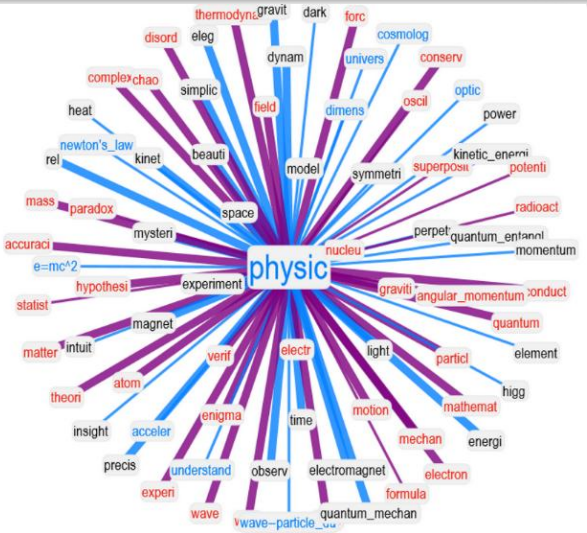


GPT-3.5

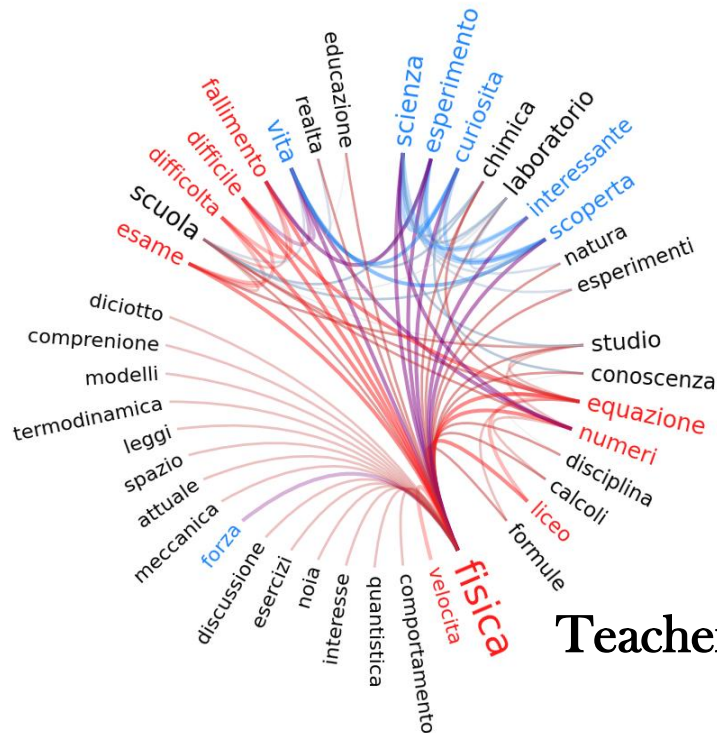
GPT-4



Teachers



GPT-4



Teachers

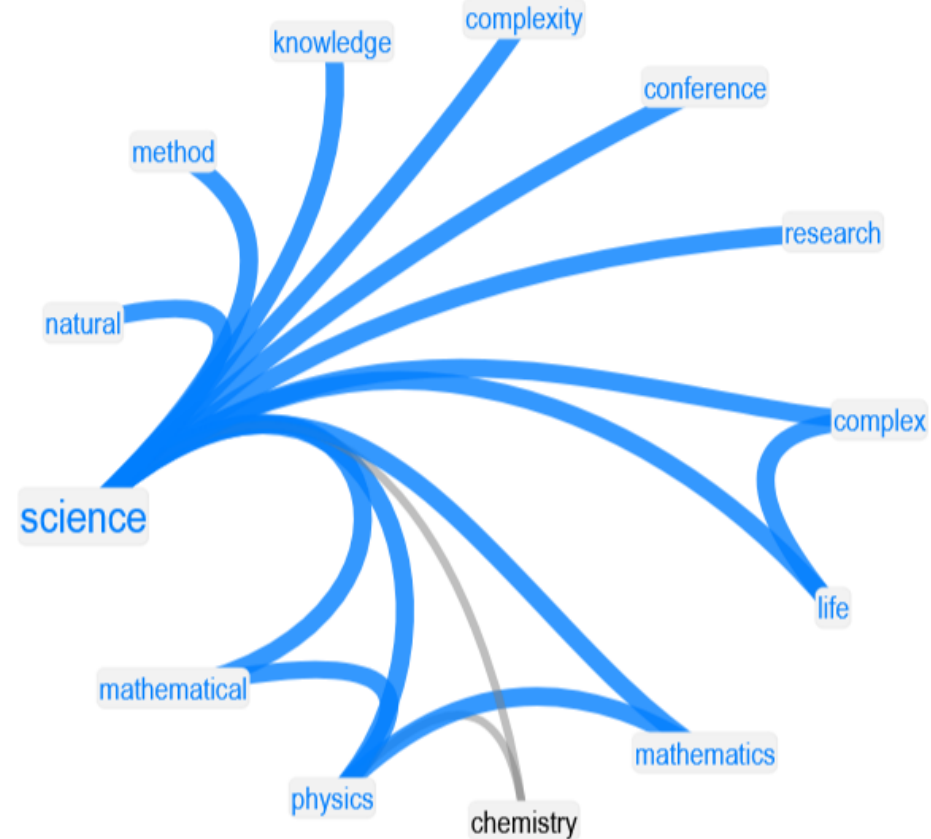
STEM Formae Mentis



Students

Scienza

Professionals

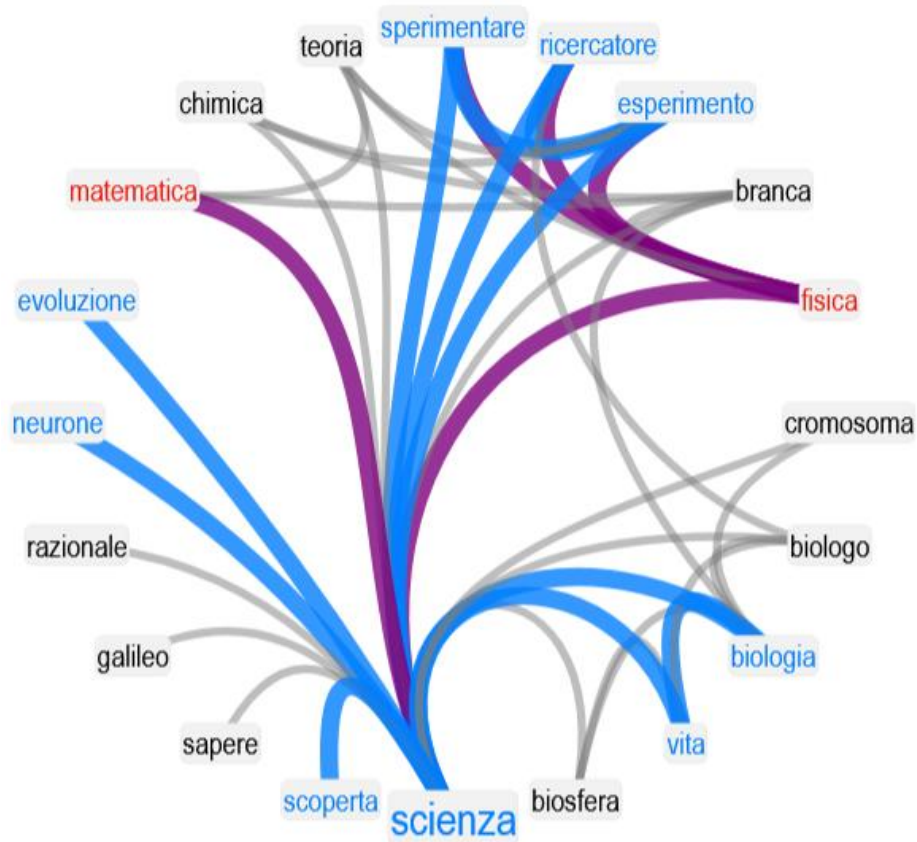


STEM Formae Mentis

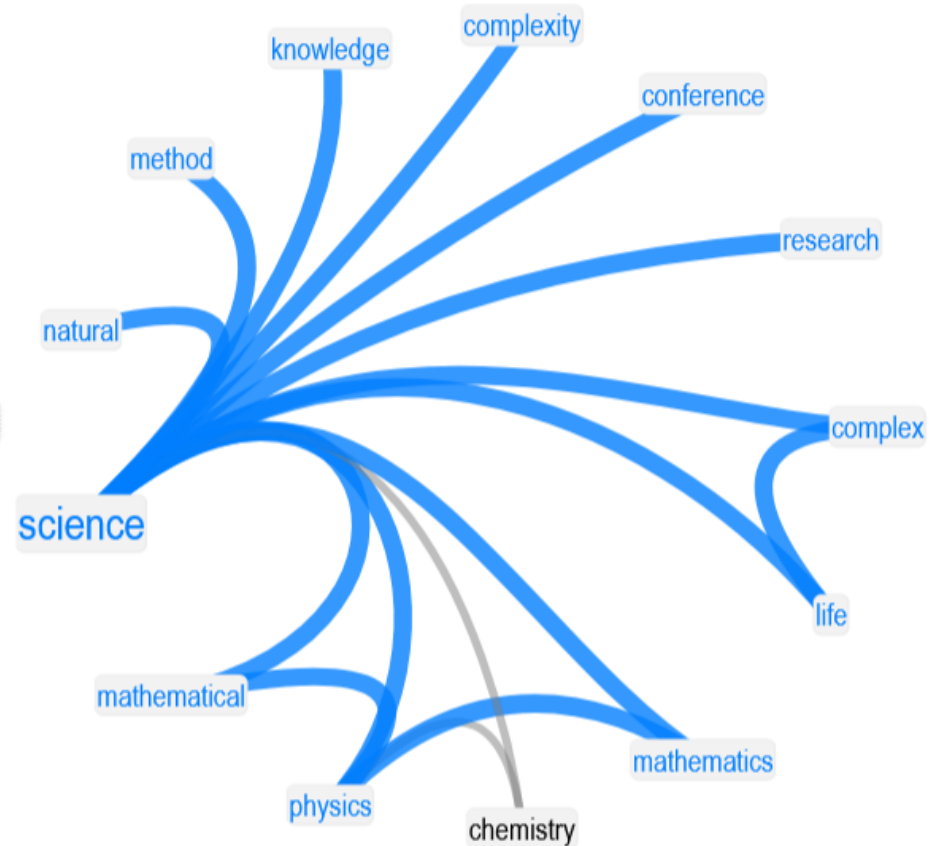


Scienza

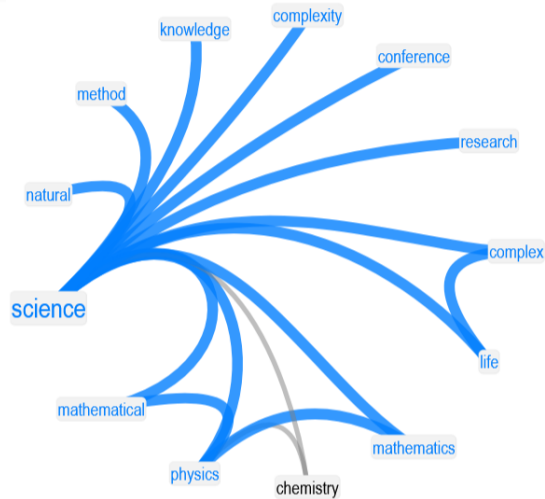
Students



Professionals



GPT e Scienza

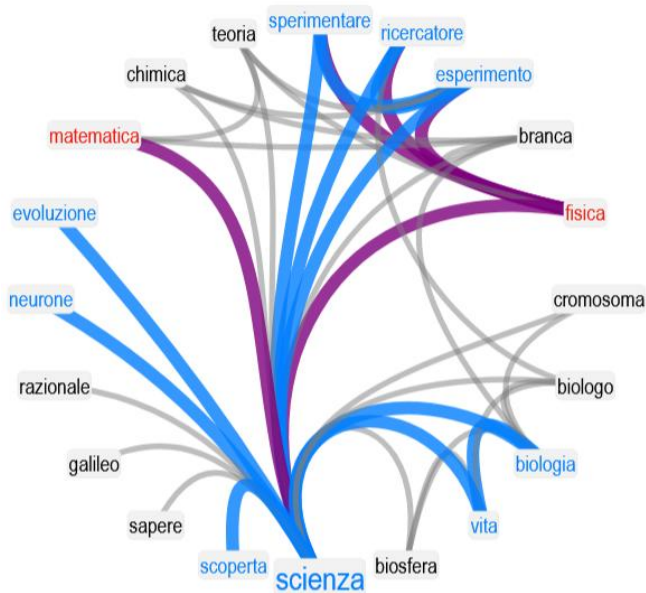


Researchers

GPT-3

GPT-4

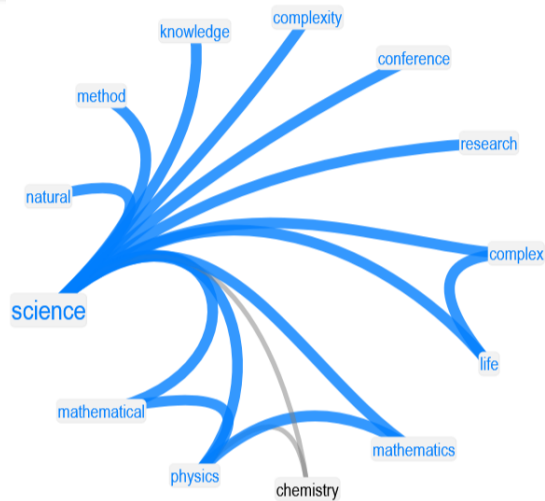
GPT-3.5



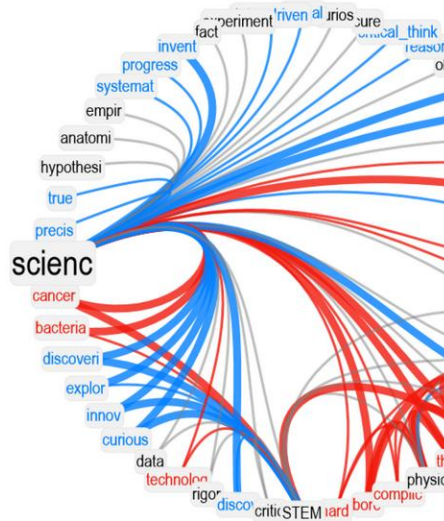
Students

Teachers

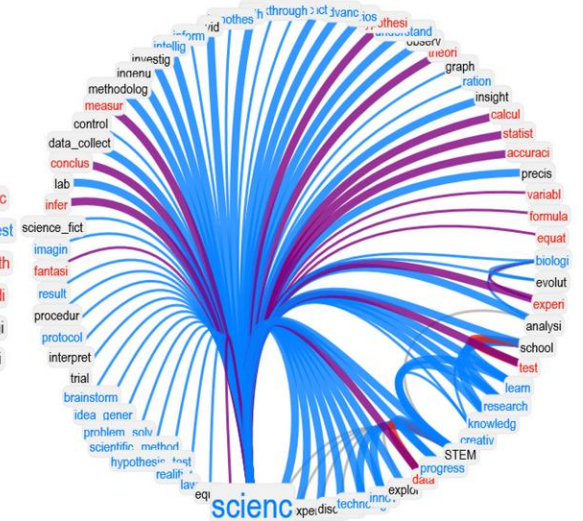
GPT e Scienza



Researchers

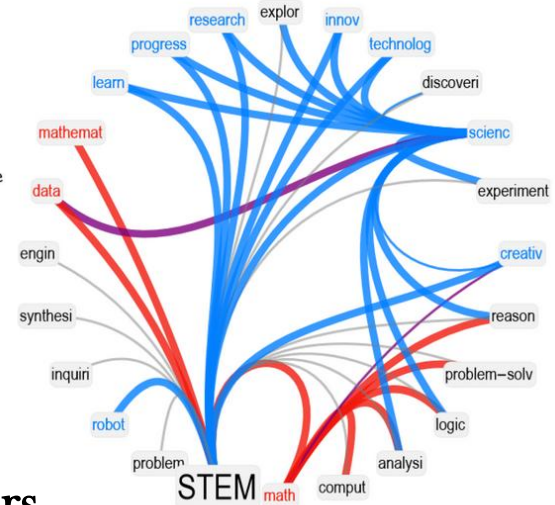


GPT-3

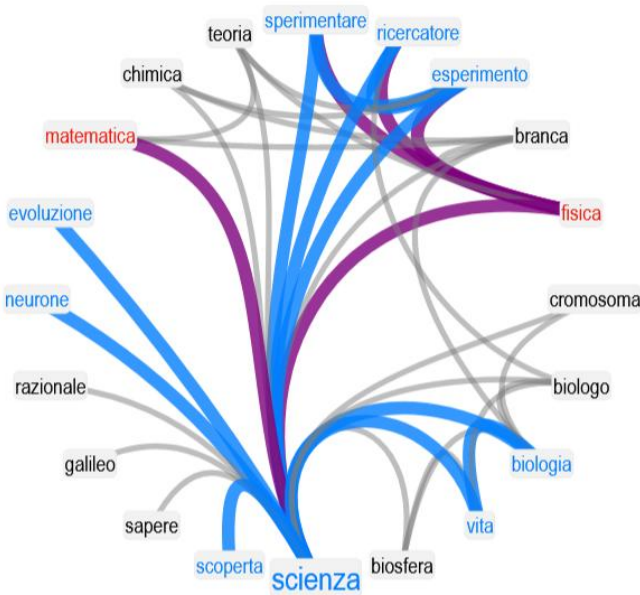
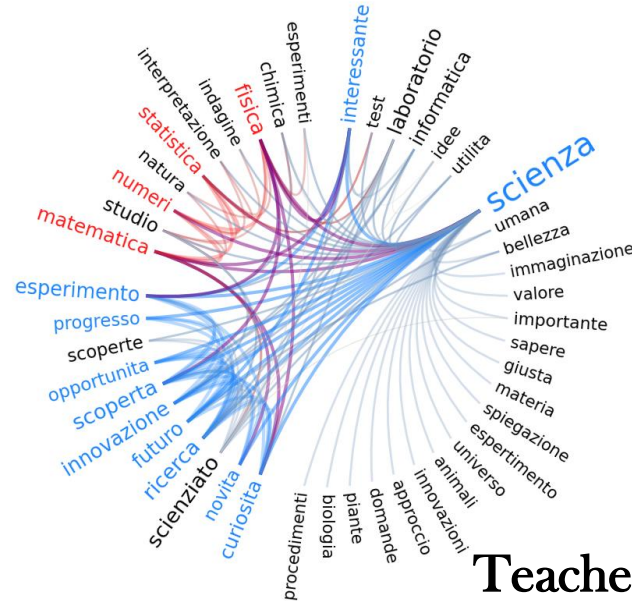


GPT-4

GPT-3.5

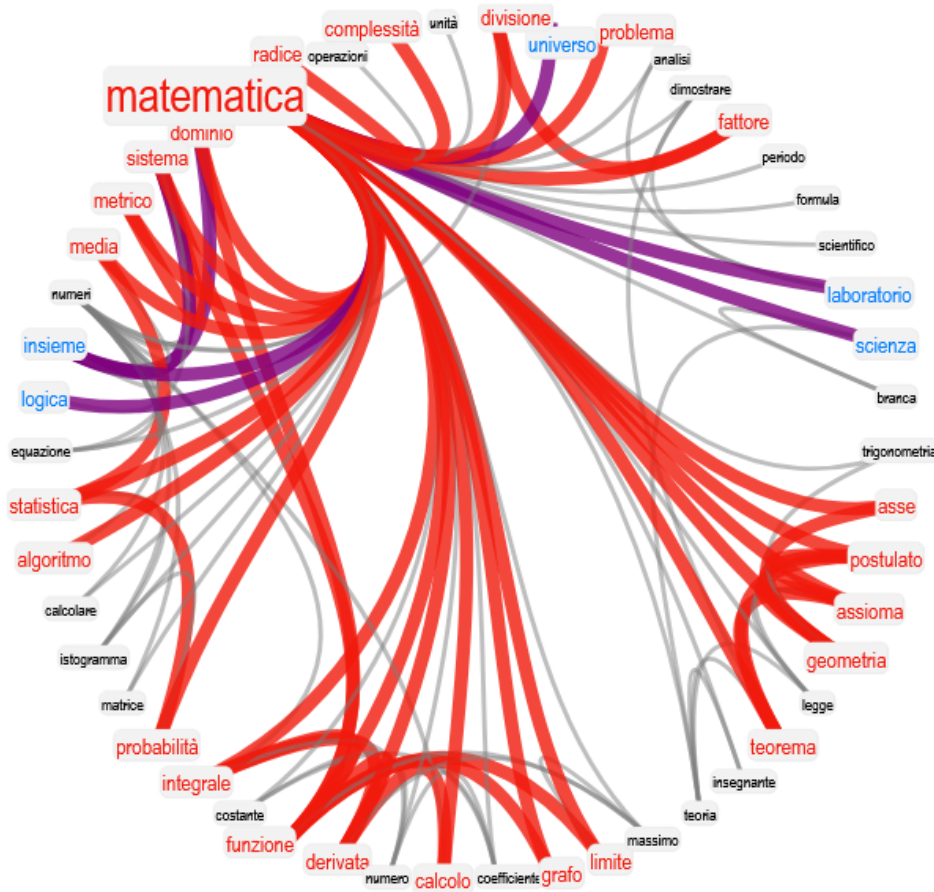


Teachers

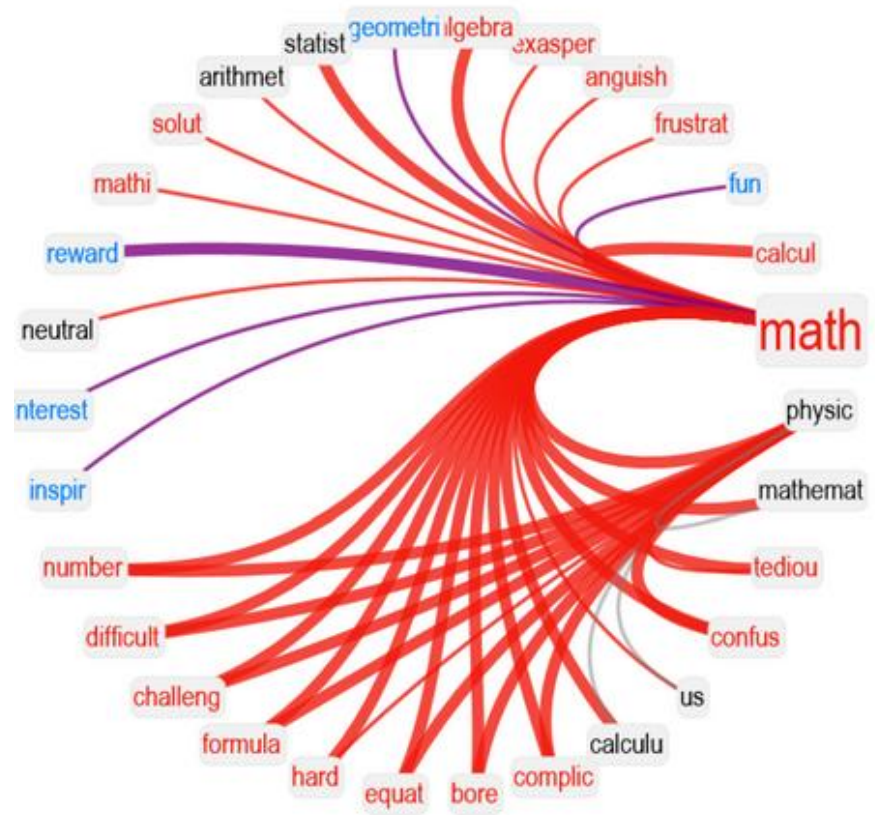


Students

Dry perceptions

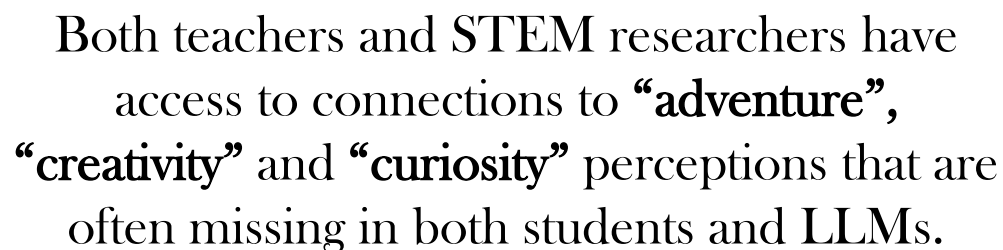


Students



GPT-3

Conceptual associations reveal a view of mathematics among students as “counting”.
GPT-3, on the other hand, is even more negative and stereotyped: math is boring!



Partecipiamo all'esperimento
forma mentis:

<https://tinyurl.com/forma26>



Prima parte: Questionari

	Mi sento ... con quest'affermazione
Ho la fiducia in me stesso/a necessaria per sperimentare modi diversi di comportarmi.	
Sono disposto/a ad ascoltare e considerare diverse alternative per gestire un problema.	
Ho difficoltà a utilizzare le mie conoscenze su un determinato argomento nelle situazioni quotidiane.	
In ogni situazione, posso adottare diverse modalità di comportamento.	

Mi vedo come una persona che...

	Per niente d'accordo	Abbastanza in disaccordo	Neutrale	Abbastanza d'accordo	Del tutto d'accordo
...si agita facilmente	☐	☒	☐	☐	☐
...ha una fervida immaginazione	☐	☐	☒	☐	☐
...tende a essere pigra	☐	☐	☒	☐	☐

Seconda parte: Associazioni Libere

Nomi singoli, anche solo un responso per riga, basta cliccare sulle caselle e scrivere.

Verbi, nomi, va tutto bene ma non bisogna pensarci troppo.

	Associazione 1	Associazione 2	Associazione 3
Numeri	equazione	formula	verifica
Imbarazzo	paura		
Compagni	tanti	amici	
Logica			
Scuola			
Ricerca			

Terza parte: Emozioni

Cliccando su ogni cella, decidere se si percepisce quel concetto come positivo, negativo o neutrale.

Ti verranno presentate 6 parole (e le loro associazioni) per pagina: per far comparire le parole successive premi la freccia per andare alla pagina seguente.

Se ci sono spazi vuoti ignorali, corrispondono alle associazioni che non sono state segnate nel task precedente.

	Numeri	equazione	formula	verifica
	Negativo ▾	▾	▾	▾