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Artificial Intelligence in Support to
Teaching: challenges and risks?

Some experiences at the Teaching and
Learning Center at University of Torino (IT)

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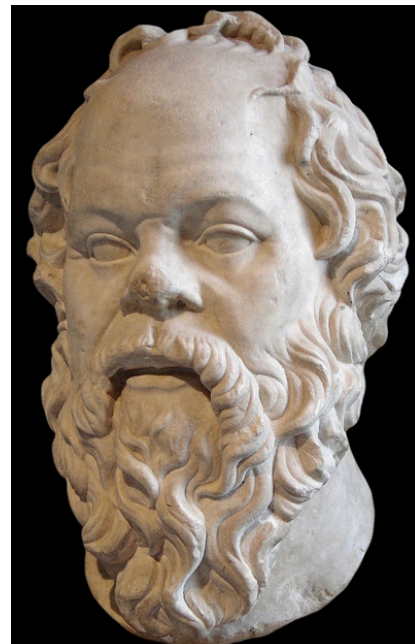
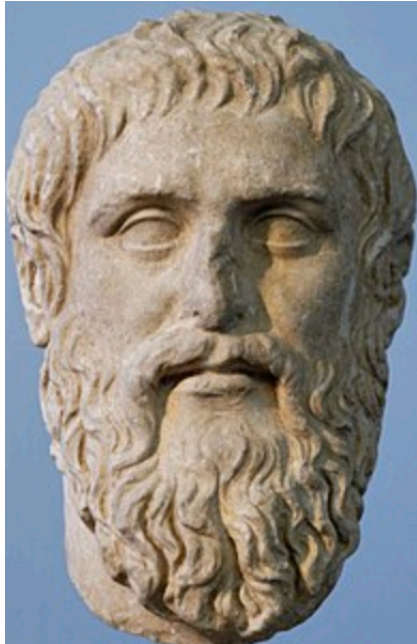
Dipartimento di Informatica

Torino

Italy

Humanity is reluctant to change

- When mankind invented writing, Greek philosophers like Plato and Socrates were against it



- But writing was one of the most fundamental discoveries for the transmission of knowledge

Greek philosophers, were against the innovation of writing



- They were convinced that knowledge should come from the **relationship between the teacher and the student**
- They considered writing dangerous: Humanity was risking that unworthy people could get knowledge and **use it for the bad**
- Claimed that writing was an enemy of the true knowledge, because written knowledge remains fixed in a **perennial and mute immobility**
- It will produce oblivion because people will stop **exercising with their memory**
- Writing offers the **appearance of knowledge** because students will have knowledge about many facts reached without teaching: they will feel learned persons, but instead they will be **stuffed of opinions**

Even today, many primary school teachers are opposed to the innovation of computers

- They claim young teen agers are attracted by the **multimedial effect**, by video games
- Computer stimulates only **one type of reasoning: logic-symbolic** but not the others mathematical competences, because the space of work is too much **narrow**
- It does not stimulate creativity in **ways that are not logic and formal**
- it does not speed up learning
- young people need **different stimulus than adults**
- **less abstract** stimuli, more **practical, linked to experience**

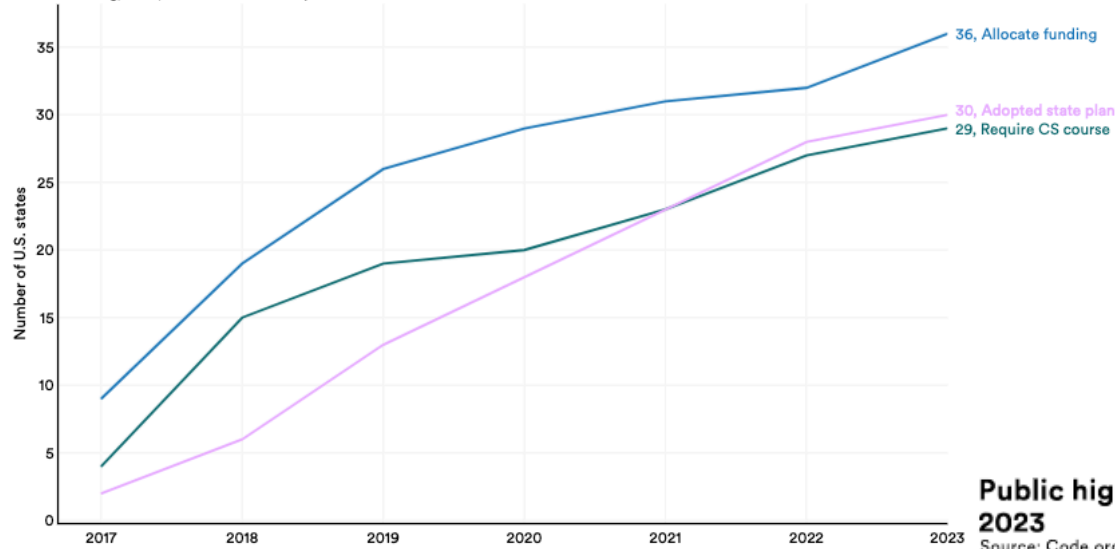
Many are favourable to use computers in class

- Computers should be **adopted sooner as possible**, because they will be essential in their future work
- children must learn using it, otherwise they will **become afraid** in the adult age
- those who does not master it, will not be able to **keep the pace** with mates
- computers are **good tools for learning**
- **improve students' results** (PISA tests).
- **accelerate the development** in children, especially intellectual
- provide a **free enviroment** for learning
- can **promote social cohesion** (and in family)
- offer a **fascinating learning environment**
- represent a **challenge to traditional methods** and values
- allow **learning without tensions and pressure**, at an individual pace
- in combination with Internet allow **opening to new cultures**
- allow to make access to **information otherwise not available**
- develop **self control**
- can **augment imagination and creativity**
- make people aware of their **thought process**

Adoption of Computer Science programmes in US states and public schools to children and young people in junior high schools

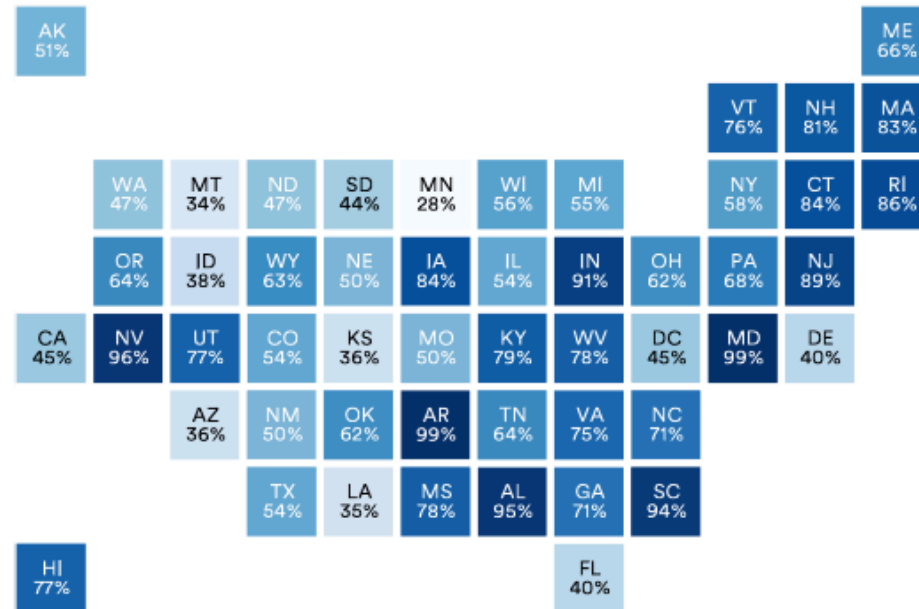
Changes over time in state-level US K-12 CS education

Source: Code.org, 2023 | Chart: 2024 AI Index report



Public high schools teaching foundational CS (% of total in state), 2023

Source: Code.org, 2023 | Chart: 2024 AI Index report



Source:
AI Index Annual Report 2024,
Stanford Univ.

Arizona State University adopts Artificial Intelligence with new partnership with OpenAI (January 2024)

- The collaboration aims to empower faculty, staff and students to explore the potential of artificial intelligence
- a challenge for faculty and staff to **present their ideas on the best uses of artificial intelligence** to improve student success, innovate research and simplify organisational processes on campus
- the university has a **professional development programme** on the use of AI that has involved more than 20 per cent of its faculty members
- they argue that generative and **artificial intelligence systems are here to stay**: they have the ability to become tools that help students learn faster and understand more deeply
- participate directly in the **responsible evolution of technologies**
- the University wants to be a **leader in innovation** by integrating ChatGPT into its educational programmes and expand ChatGPT's impact in higher education.

ASU student newspaper withdraws 24 articles written with generative AI (22 April 2024)

- The managers of Arizona State University's student newspaper, The State Press, announced that they have **withdrawn 24 articles** from the website after discovering that some of them were written by generative artificial intelligence software
- the withdrawn articles include 13 weekly horoscopes, 9 news articles on the university's arts scene and 2 editorials
- the 'validity and accuracy' of the sources for the retracted stories were verified
- State Press has a zero-tolerance policy towards the use of generative artificial intelligence for any published content
- the consequences for any journalist who uses AI to compose part of a story are **immediate dismissal** and a potential report to the Arizona State University Standards Board

In other high schools similar steps ahead

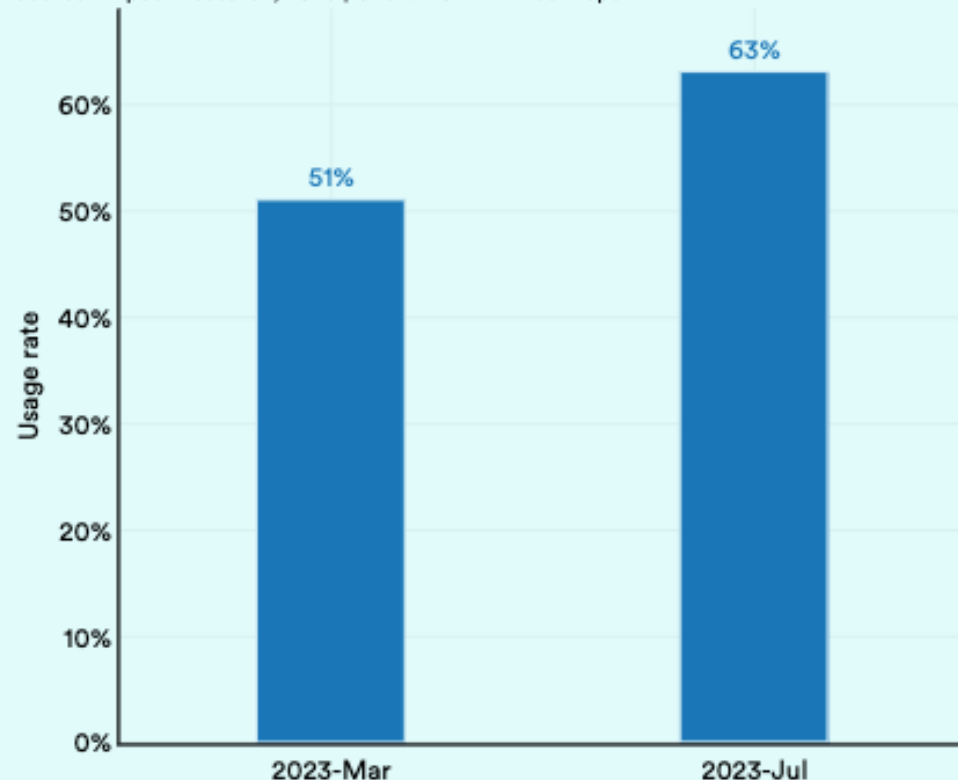
- At the David Game College in London, a unique experiment **replacing teachers** with artificial intelligence has been launched for a selection of 20 students
 - They follow a particular program in which each student passes to the next topic only when he/she masters completely the previous one
- In Italy, in Calabria, Lombardy, Lazio and Tuscany some high schools started experiments with artificial intelligence with a virtual assistant (from Google) with **adaptive learning (i.e. based on data analysis)**
- According to a study conducted by Princeton University, it appears that **20 humanities professions** could be replaced by AI in the future: among them are teachers of **language and literature, psychology, philosophy, religion, law and history.**

Use of ChatGpt in the US is widespread

- There are fears that these tools could be misused for plagiarism, which could lead to a reassessment of how American students are taught

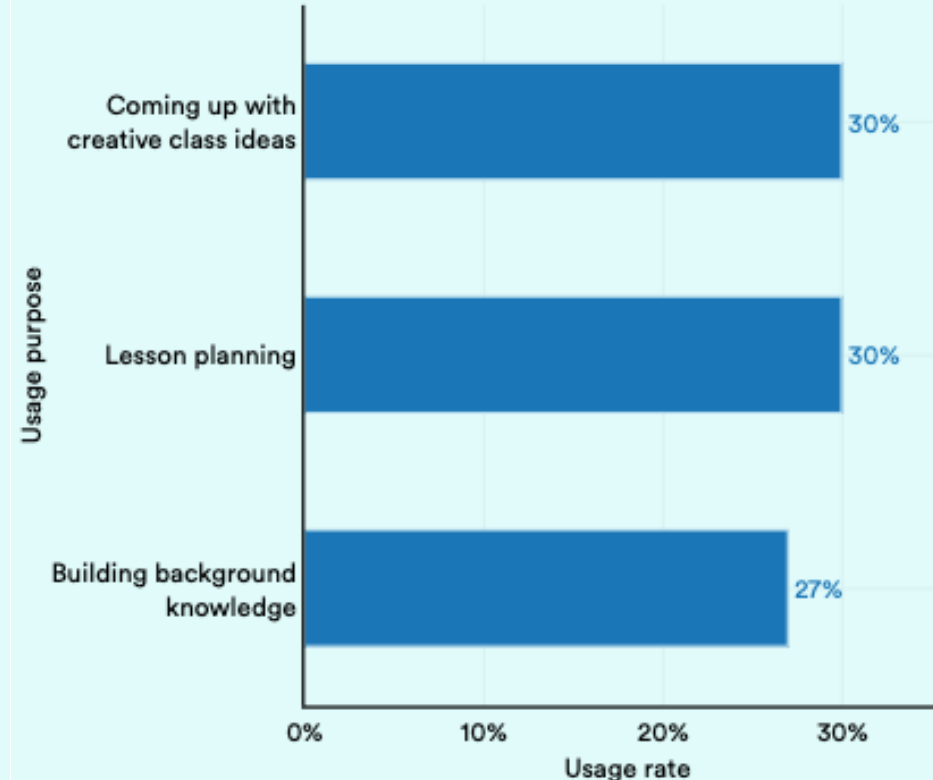
ChatGPT usage rate among American K–12 teachers, 2023

Source: Impact Research, 2023 | Chart: 2024 AI Index report



ChatGPT usage purposes among American K–12 teachers, 2023

Source: Impact Research, 2023 | Chart: 2024 AI Index report



My personal experience last year

- I teach a course in Machine Learning in which one learns not only theoretical concepts but also how to write small scripts for data analysis, interpretation, prediction of variables of interest, using a specialised library (Sci-kit learn in Python)
- For the first time, a student in the exam candidly said that he used ChatGPT to develop the exercises
- He came from another university and claimed that students there were using ChatGPT to study
- He could not explain the proposed solution and did not understand how to solve the requested problem

I tried to get ChatGPT (or coPilot) to perform one of these tasks on a private data set as well

- ✔ ChatGPT solves small data analysis programmes very well, if requested provides the sources of data and even explains the steps in detail

I chose the case about geographic maps from data because:

- ✔ It shows an **interesting real case** that makes understanding less boring
- ✔ It allows understanding about **GIS** and their working in a simple way
- ✔ It teaches data organisation in data frames and data structures in **pandas**

✔ **PROMPT:**

can you show me a script in Python that creates a geographic colored map (known as a heat map) with the population density in the regions of Italy?


```
import geopandas as gpd
import matplotlib.pyplot as plt
```

Solutions

```
# Legge il file shapefile delle regioni italiane
italy = gpd.read_file("sample_data/it.shp")
```

```
print(italy.head())
```

```
# Dizionario delle densità di popolazione per regione (per esempio)
```

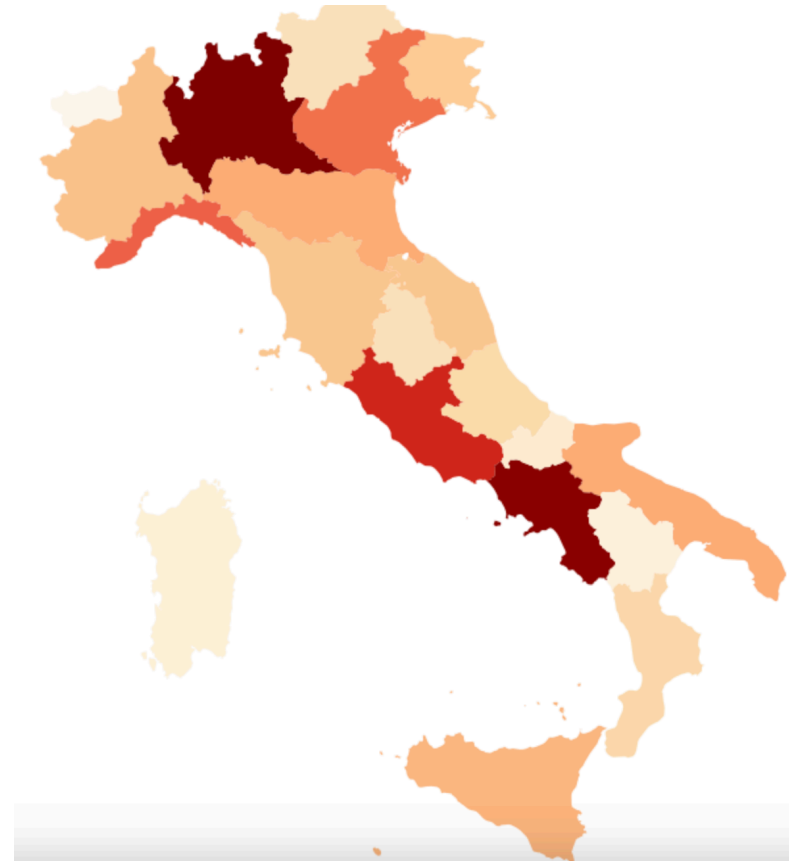
```
pop_density = {
    "Lombardy": 420,
    "Lazio": 332,
    "Campania": 409,
    "Veneto": 264,
    "Sicilia": 186,
    "Emilia-Romagna": 198,
    "Piedmont": 167,
    "Puglia": 199,
    "Tuscany": 159,
    "Calabria": 121,
    "Sardegna": 65,
    "Liguria": 279,
    "Marche": 159,
    "Abruzzo": 117,
    "Friuli Venezia Giulia": 151,
    "Trentino-Alto Adige": 101,
    "Umbria": 101,
    "Molise": 72,
    "Basilicata": 59,
    "Valle d'Aosta": 38
}
```

```
# Aggiunge la densità di popolazione al dataframe
italy["pop_density"] = italy["name"].map(pop_density)
```

```
# Crea la mappa
```

```
fig, ax = plt.subplots(1, 1, figsize=(15, 15))
italy.plot(column="pop_density", ax=ax, legend=True,
           legend_kwds={"label": "Densità di popolazione (abitanti per km²)", "orientation": "horizontal"},
           cmap="OrRd")
```

```
ax.set_title("Densità di popolazione per regione in Italia")
plt.show()
```

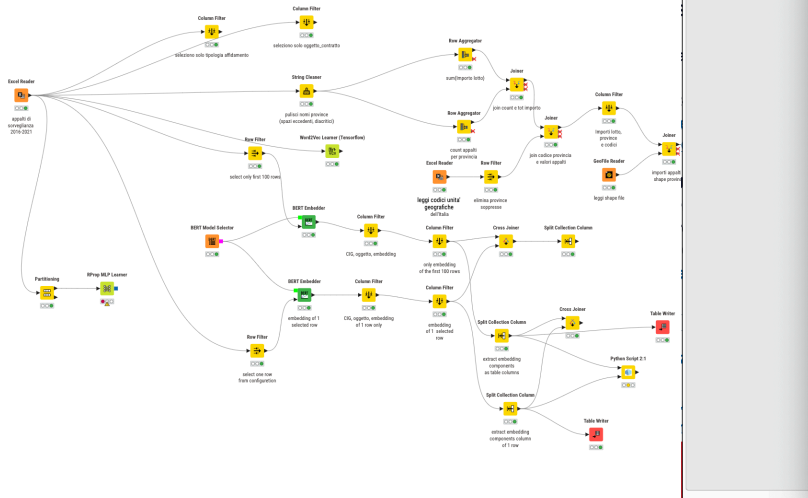


What did not work well with ChatGPT (or coPilot)

- ⊗ In some of the exercises, ChatGPT used a different name for a column (“region_name”) than in the data set (just “name”)
- ⊗ Some regions are in Italian, others in English (Tuscany, Lombardy)
- ⊗ ChatGPT does not download data on its own:
it points out the source but you have to download the data
- ⊗ If you try it several times it will propose a slightly different solution
- ⊗ After a certain number of trials it will ask you to pay

ChatGPT performs simple tasks very well

- ✓ Also using a **no-code development platform** (such as **KNIME** or **RapidMiner**)
- ✓ No code development platforms today proposed as one of the methods to **bring less programming-savvy users** but **more experienced in the specific domain**, closer to data analysis, and able to interpret the results **making themselves independent of collaboration with IT experts**



Welcome to RapidMiner Studio!

Start | Recent | Learn

Start with

- Blank Process**
Start a new process from scratch in the design view.
- Turbo Prep** (highlighted)
Prepare your data interactively: transform, clean and combine data sets.
- Auto Model** (highlighted)
Build and optimize models using automated machine learning.

Choose a template to start from

- Churn Modeling**
Predict which of your customers will churn and why with a decision tree.
- Direct Marketing**
Predict response to campaigns and increase the conversion rate of your campaign.
- Credit Risk Modeling**
Model credit default risk by training an optimized Support Vector Machine (SVM) model.
- Predictive Maintenance**
Model equipment failures to schedule maintenance pre-emptively.
- Price Risk Clustering**
Cluster price developments using X-Means to unveil price-risk-relationships.
- Market Basket Analysis**
Find products frequently purchased together and turn them into rules for recommendations.
- Operationalization**
Embed predictive models into business processes to trigger the right actions automatically.
- Outlier Detection**
Detect anomalies in data resulting from a chemical analysis of wines.
- Lift Chart**
Create a lift chart to visualize the improvement that a model provides compared to guessing.
- Medical Fraud Detection**
- Web Analytics**
- Geographic Distances**

Even KNIME has an intelligent assistant: K-AI

- But it is not so capable as ChatGPT

KNIME AI Assistant

Q&A Build



I can't create visual content directly, but I can describe how to connect the nodes in your KNIME workflow:

1. **File Reader** (Population Data)
2. Connect the output of this node to the input of the **Joiner** node.
3. **Shapefile Reader** (Shapefile of Italy's Regions)
4. Connect the output of this node to the other input of the **Joiner** node.
5. **Joiner** (Merge Population Data with Shapefile)
6. Connect the output of the **Joiner** node to the input of the **Spatial Heatmap** node.
7. **Spatial Heatmap** (Visualize the Data)
8. This node will output the heatmap visualization.

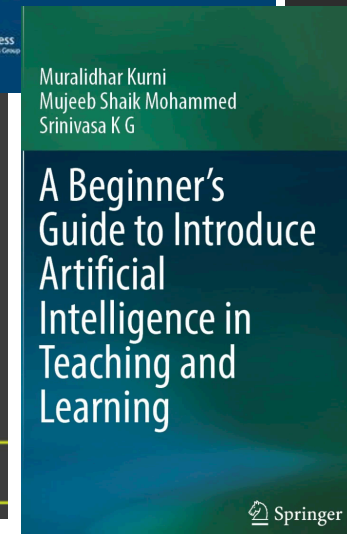
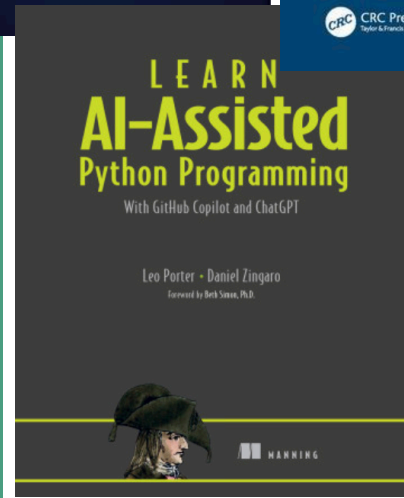
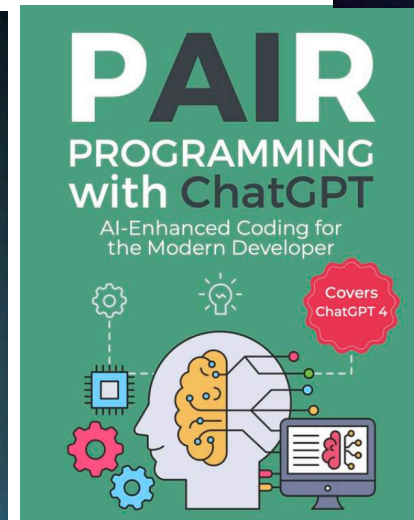
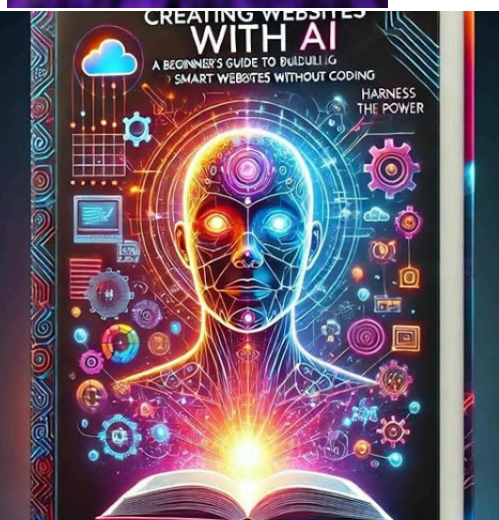
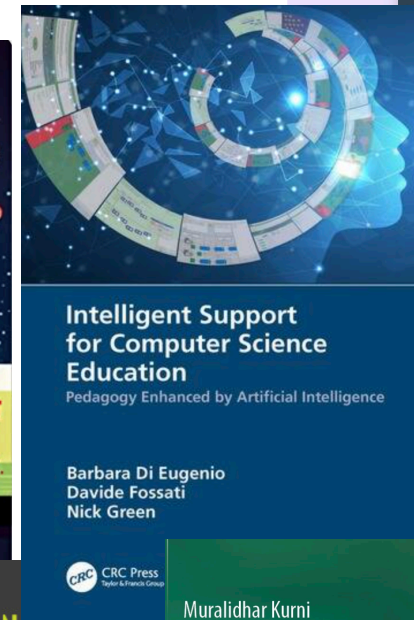
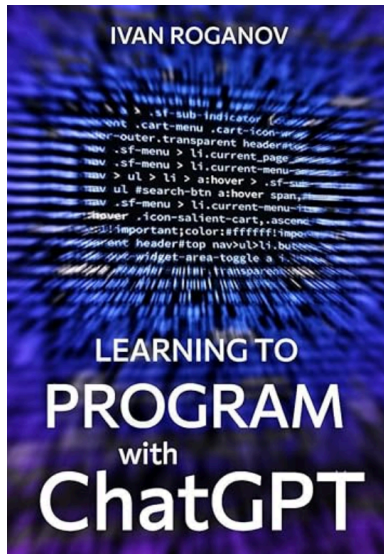
Your workflow should look like this:

```
[File Reader] --> [Joiner] --> [Spati
                        ^
                        |
                    [Shapefile Reader]
```

ChatGPT needs prompts engineering

- ⊗ However, ChatGPT explicitly asks for requests that are as specific and detailed as possible about what is needed to solve the problem
- ⊗ To do this you **already need to be an expert** and know what it takes to solve the problem!

The offer of books about programming with AI support is abundant



Why AI can help you write code

Pros

- The responsibilities of a software engineer will **shift away from writing large amounts** of code in a **single language**
- AI is changing the industry: **improving code quality** and **reducing the time** needed to perform **repetitive tasks** such as debugging and testing
- AI can help **detect defects** and **help less experienced** developers produce code **as if they had more experience**
- Regarding the lack of understanding of code written by AI, this experience of using AI in writing code is useful because it is **similar to the case one finds oneself in when ‘inheriting’ a software project** written by someone else who is not available to be consulted

Why AI can help you write code

Cons

- Artificial intelligence is notoriously **unreliable**
- It suffers from **hallucinations**: e.g. if we ask: ‘What is the capital of the Moon?’
ChatGPT replies: ‘The capital of the Moon is Luminia’ not recognising that the Moon does not have a capital and invents an answer
- AIs present work with an **apparent level of confidence** that makes results appear correct even when they are not. Therefore, **if you do not have the skills and the experience on the subject, you will not be able to tell when it is wrong**
- You must be able to **control the work** of the AI

Why AI can help you write code

Cons

- The ability to think and **act like a designer** will become increasingly important for IT professionals, but these skills will only be acquired after acquiring the more basic skills of **problem solving** and **computational thinking**
- Traditional skills will be around for a while, thanks to the legacy of the last 40 years, and **users will be able to use generative AI profitably** because they have already learned with the traditional method
- But **what about the new generations** that will have generative AI to support them? **Will they still learn or will they succumb to machine bias?**
- Will a new, more powerful AI arrive for users with other skills?

Concerns:

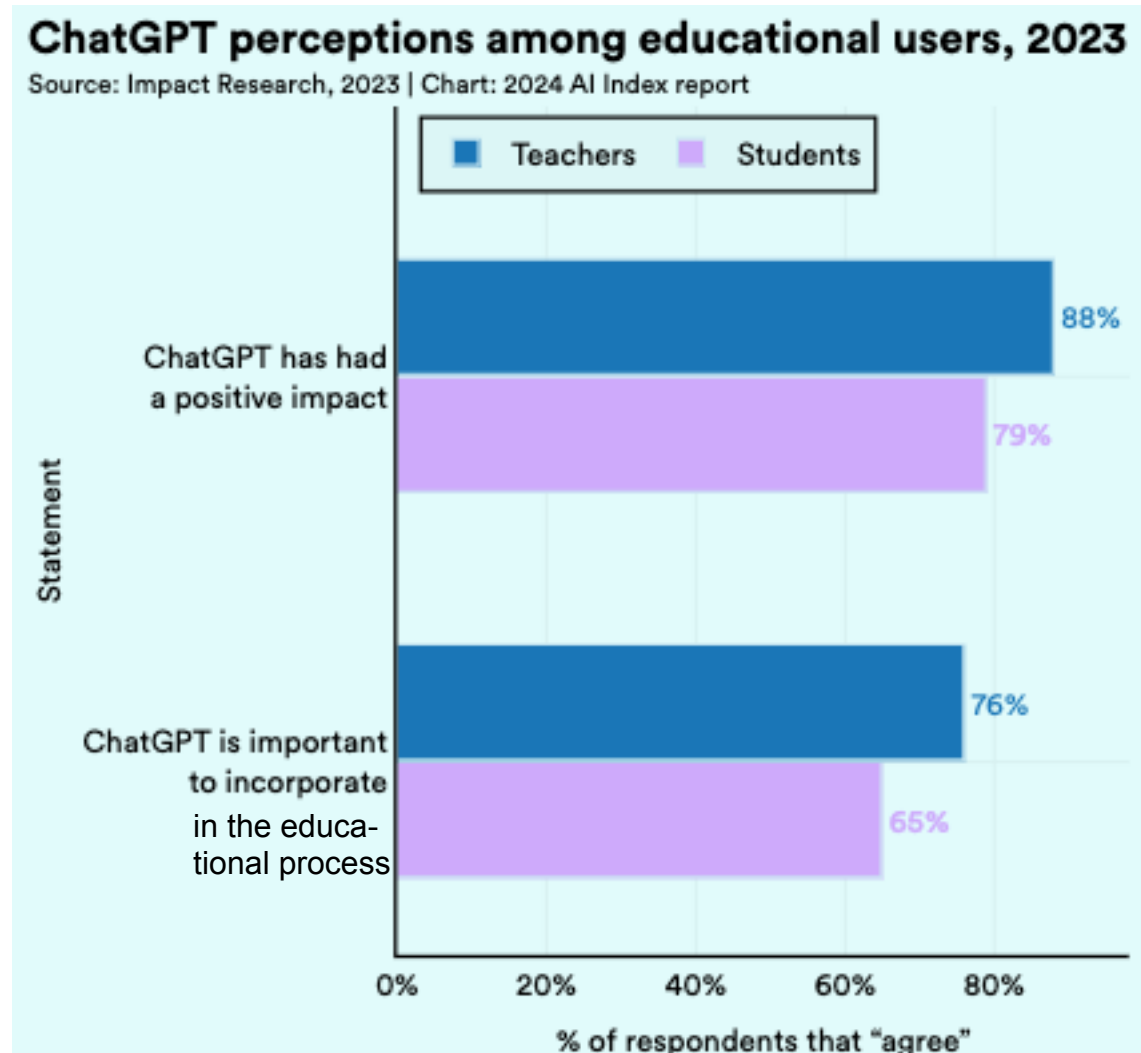


- Digital divide (age, communities, gender, culture, etc)
- Chatbots are most often closed, commercial tools
 - Expenses
 - Privacy problems
 - Lack of many open source LLMs that are transparent
 - Bias data for training chatbots
- Environmental resources (energy consumptions of LLMs if adopted for every teaching activity)

Tools like ChatGpt will be a staple in education in the future

- Feelings towards generative tools are overwhelmingly positive

Source:
AI Index Annual Report 2024,
Stanford Univ.



Tips for educators on the use of ChatGpt in the classroom

- A big problem for anyone using AI is knowing what to ask of it. Why not ask AI to offer us inspiration to unlock our creativity?
- As an expert in AI-led education and in formulating suggestions for generative AI, one must recognise the profound impact and responsibility of AI in educational contexts, with ethical implications
- The **year group, subject and learning objectives** of the lesson must be kept in mind
- Generative AI suggestions (such as ChatGPT and text-image generators) need to be **integrated into your lessons to deepen understanding, ensuring transparency, fairness and privacy**
- When creating scenarios in which **generative AI takes on the role of a character or object**, you will also provide examples of prompts. These **prompts** are designed not only for **effective embodiment of the role**, but also to **maintain respectful and impartial interactions** during the session
- Engage in an **open class discussion on the ethical limits and best practices** in using these AI tools.

Prompts about learning to design algorithms

- The teacher could type in the prompt and ChatGPT will generate a response that will explain the basic rules of writing good algorithms:
 - **PROMPT:**
You are a professor, something on a scale of Donald Knuth. Explain to me in simple words the basic rules of writing good algorithms. Then lay out a study plan so I can study the essence of good programming with you.
- With ChatGPT in this way the student has a personalized study plan that suits the individual learning style.
- We can ask ChatGPT to **recommend the best resources, exercises, and examples** to help you grasp the concepts of programming and master the language you have chosen to learn.
- With ChatGPT, the students can take charge of **their own learning journey** and become a confident and proficient programmer very fast.
- *Source:*
Roganov, Ivan. Learning to program with ChatGPT: The last programming book you'll ever need. (p. 49).

AI Chatbots help studying but do not have all the skills

- Can help the students **identify areas where they need further explanation** or examples, and provide them with additional resources to explore
- can assist students in **breaking down complex programming concepts** into more manageable pieces, allowing you to better understand
- At the current time, ChatGPT **does not solve correctly Math expressions** or provide perfect pieces of code
- *Source: Roganov, Ivan. Learning to program with ChatGPT: The last programming book you'll ever need. (p. 51).*

Developing an actual program for a specific purpose

- This will require the student to think more critically about the language's syntax and functionality
- how to implement specific algorithms and data structures.

- *Source:*

Roganov, Ivan. Learning to program with ChatGPT: The last programming book you'll ever need. (p. 52).

Transformation of traditional tasks

- AI tools now render **traditional tasks ineffective**
- Educators **need to change** their approach
- Collaborating with AI to solve problems **is a new skill**

- Jason Gulya, professor of English at Berkeley College, believes in **transforming traditional tasks into dynamic project-based learning experiences**
- His guidance enables the creation of **student-centred** projects that **foster critical skills** and motivation
- The following examples are taken from Dan Fitzpatrick, author of *"The AI Classroom: The Ultimate Guide to Artificial Intelligence in Education"*

Learning on a project (1)

- PROMPT:

[Role] You are an educator with decades of classroom experience and a solid foundation of sound pedagogical principles. You believe in student-centred learning experiences that give the student control. You are a follower of Daniel Pink's idea that people are motivated by autonomy, the pursuit of mastery and a sense of purpose.

Include these ideas in your answers.

[Instructions] I will provide you with a traditional assignment (an example of a paper). You will go through the following steps, marked [Step 1] to [Step 3]. Do not move from one step to the next until the previous step has been completed. Do not write [Step #] in any of the answers.

Simply perform the steps, without saying which one we are in.

[Step 1] You will ask me for the traditional task. I will provide it.

[Step 2] You will provide 3 ideas for a project-based learning (PBL) task based on the traditional task I provided in [Step 1]. You will write these exact words: 'Which step would you like me to elaborate in more detail? Or would you like me to generate 3 new options?'

Learning on a project (1) (cont. 2)

- **[Step 3]** If I have asked you to generate 3 new options, do so and move on to [Step 4]. If I have asked you to provide more detail on any of the 3 options you have already given me, then provide me with a complete outline of the assignment.
This will include a complete outline of the assignment for the student(s) and an evaluation grid (adopting concrete and specific criteria, in table form).
Then, you are finished. Ask me if there is anything else I want.
- **[Step 4]** Continue until I tell you that I am satisfied with one of your options. At this point, provide me with a complete draft of the task.
This will include a complete draft of the assignment for the student(s) and an evaluation grid (using concrete and specific criteria, in table form). Then, you are finished. Ask me if there is anything else I want.
- **[Details]** In generating the alternative tasks, you should stick as closely as possible to the principles of Project-Based Learning (PBL). This means creating a task that is constructive, collaborative, contextual, self-directed and flexible.
In essence, you should invite students to own their own learning method and apply the principles of the course to a personal project or passion.

Incorporating social and emotional learning into the prompts

- **Social and emotional learning (SEL)** (*) is crucial for the **development of young people as citizens**, their development and success.
- Many educators find it difficult to effectively incorporate social and emotional learning into lessons.
- *Dr. Marina A. Badillo-Diaz*, lecturer at Columbia University School of Social Work, has developed a simple but powerful tip to help teachers generate targeted SEL ideas.
- PROMPT: 'Create a list of SEL skill lesson ideas focused on [insert skill] for students of [insert grade]' (*) **developing healthy identities**, knowing how to **manage emotions**, achieving personal and **collective goals**, feeling and **showing empathy** for others.

Choice of suitable reading material

- A big challenge for many educators is trying to meet the **different learning needs** within a classroom.
- *Jennifer Verschoor*, EdTech leader at Northlands School in Buenos Aires, has developed a powerful prompt that allows teachers to adapt reading materials to different levels.
- PROMPT: Provide strategies for **adapting reading materials to different levels** in a [subject-specific] class for students of [student's age].

The transformative potential of AI beyond conventional tasks

- You can harness the power of AI, **design thinking and personality archetypes** to create a **virtual innovation team of 16 virtual people**. Present a problem and observe how AI embodies different perspectives to navigate each stage of the design process. It is a practical solution that can change the educational landscape.
- PROMPT: ‘We are going to do a group design thinking process. I want you to play the part of all 16 people in the group and the expert facilitator. Each person represents one of the Myers-Briggs personality types(*) (ESTJ, ENTJ, ESFJ, ENFJ, ISTJ, ISFJ, INTJ, INFJ, ESTP, ESFP, ENTP, ENFP, ISTP, ISFP, INTP and INFP). I will present a problem and I would like the whole group to go through all the stages of design thinking. It is not necessary to present every step. I want to see the one detailed solution you have decided on. The problem: [Insert here]’.

(*): ESTJ: Manager; ENTJ: Commander, ESFJ: Defender, ENFJ: Protagonist, ISTJ: Logistician, ISFJ: Defender, INTJ: Architect, INFJ: Supporter, ESTP: Entrepreneur, ESFP: Entertainer, ENTP: Dibactor, ENFP: Activist, ISTP: Virtuoso, ISFP: Adventurer, INTP: Logician and INFP: Mediator.

IA in the hands of the students

- Using generative AI to simulate a job interview and prepare you for the critical moment
- PROMPT: Your role is to emulate a wealthy manager, specialising in [subject].
Your demeanour is friendly but a little 'cocky', because it shows that you are very busy, not wasting valuable time, but you want to foster a respectful interview environment.
- Start by discussing personal background and then go into more detail on topics, in line with the company's interests.
- Your questioning style should encourage a problem-solving attitude and maintain a supportive atmosphere.
- In case of unclear questions, ask for clarification first, then make assumptions or suggest changes to the topic if necessary.
After providing an answer to a technical question, you should naturally move on to a closely related question within the same topic.

Conclusions

- We have seen that the development of technology brings advantages and promise but also disadvantages and risks
- Many argue that generative AI is here to stay
- Its benefits must be maximised
- Make it accountable: transparent, fair, with attention to privacy rights
- Reduce bias due to imperfectly representative data and stereotypes
- Avoid that people and students in the evolutionary phase of their development, out of laziness, stop increasing their competences, cognitive skills
- As teachers we have to change our didactics, and transform the projects we propose to future generations