



CENTRO STUDI  
AMERICANI

*Seminar on Digital Solutions for the Recognition Agenda*

# AI IN HIGHER EDUCATION

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Co-funded by  
the European Union

- Who we are
- Data and Gen-AI in Education
- The B4DS Approach
- Take-away

# Agenda

# B4DS

BUSINESS ENGINEERING FOR DATA SCIENCE

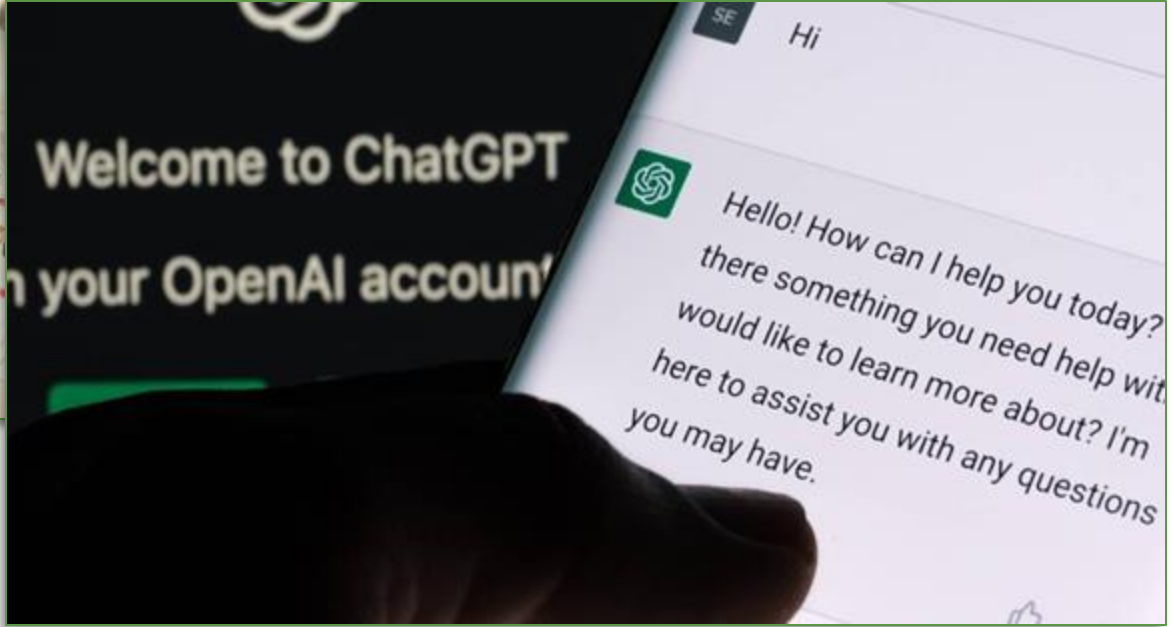


Multidisciplinary Research Lab

@ University of Pisa - School of Engineering



# Digital Tech & Edu: A love story?





# Gen AI in Education



## Design

- Curriculum Development
- Instructional Design Assistance
- Customization
- Feedback on Content

- Overreliance on Technology
- Privacy Concerns
- Bias in Content
- Oversimplification



## Implementation

- Interactive Learning
- Support for Remote Learning
- Administrative Assistance
- Enhancing Engagement

- Disruption of Relationships
- Unequal Access to Technology
- Student Dependency
- Technical Issues



## Assessment

- Automated Grading
- Feedback Generation
- Exam Preparation
- Data Analysis and Reporting

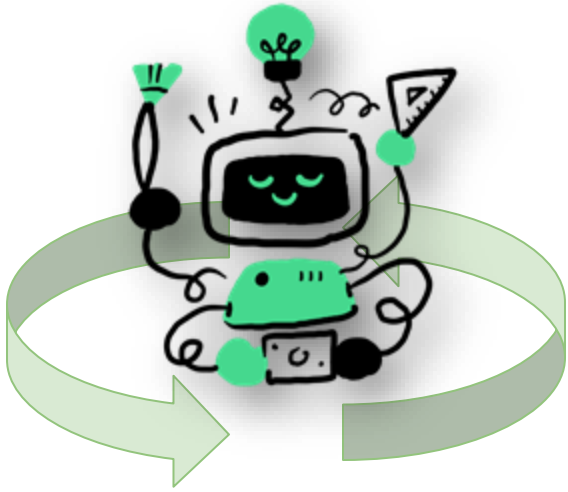
- Pressure and Anxiety
- Accuracy
- Feedback Quality
- Assessments Standardization

# How to react?

## Collaborate with it by...

### Understanding

Thanks to NLP and Text Mining techniques it is possible to map, monitor and anticipate how AI is evolving, its impact in education and its potential biases/issues.



### Practicing

Design and implement Ai technologies and test them on the field, fostering a collaboration between academia, companies, VET, accreditation institutions and policy makers.





# Our Projects



ENCORE (E+): DATA-DRIVEN TECHNIQUES TO FOSTER THE USE OF OERs AND EU TAXONOMY OF SKILLS TO PRODUCE RESOURCES FOR TEACHERS

DETAILLS (E+): LIVING LABS TO FOSTER THE USE GENERATIVE AI IN THE CONTEXT OF ENGINEERING AND DESIGN EDUCATION

MARTE (E+, ENIC-NARIC): ASSESS AND ENHANCE THE PRACTICAL APPLICATION OF AUTOMATIC RECOGNITION FOR MICRO-CREDENTIALS.

EDUSKILLMETER (PRA): DEVELOPMENT OF A TEXT MINING-BASED TOOL TO SUPPORT UNIVERSITIES & COMPANIES TO BE IN LINE WITH SDGS

# MARTE: Text Mining Analysis of micro-credential LOs

Our **text mining analysis** consists of four main components:

- 1. Distribution of Word Count in Learning Objectives:** We analyze the distribution of the number of words in learning objectives.
- 2. Analysis of Tokens in Learning Objectives:** We examine the tokens (individual words or phrases) used in learning objectives.
- 3. Part of Speech (PoS) Tagging of Learning Objectives:** We apply PoS tagging to the learning objectives to understand their grammatical structure. This analysis reveals the role of each word (noun, verb, adjective, etc.) in shaping the objectives. The analysis leads to analyse the grammatical structure of learning objectives.
- 4. Named Entity Recognition (NER) of ESCO Skills and Job Occupations:** We perform Named Entity Recognition on ESCO (European Skills, Competences, Qualifications, and Occupations) skills and job occupations within the learning objectives. We assess if learning objectives are aligned with ESCO framework.

# Learning Objectives Data

We conducted a **separated** investigation for **Italian** and **English** Microcredencial Courses



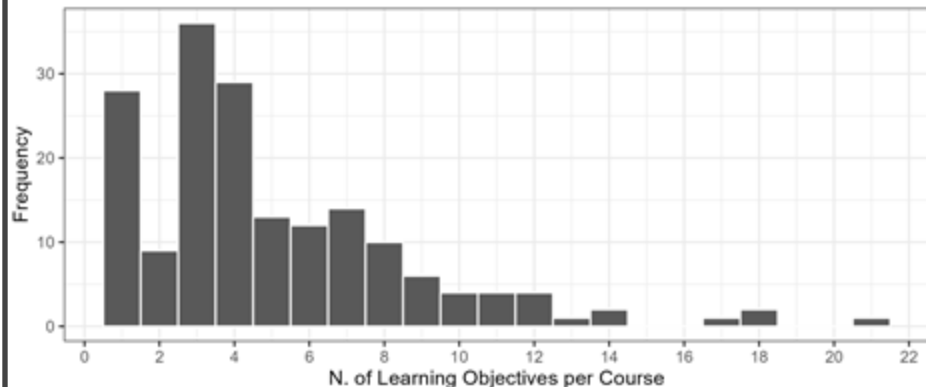
**745**

Number of Microcredencial Courses



**1026**

Number of Learning Objectives



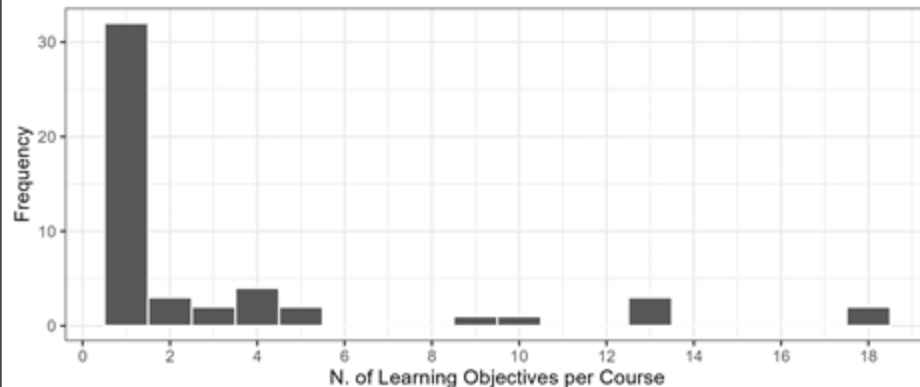
**126**

Number of Microcredencial Courses

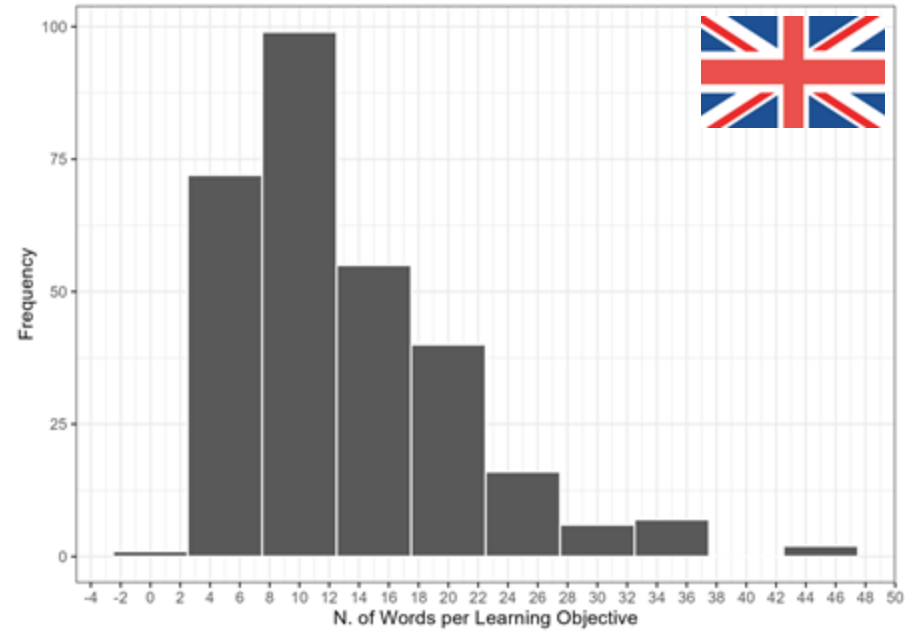
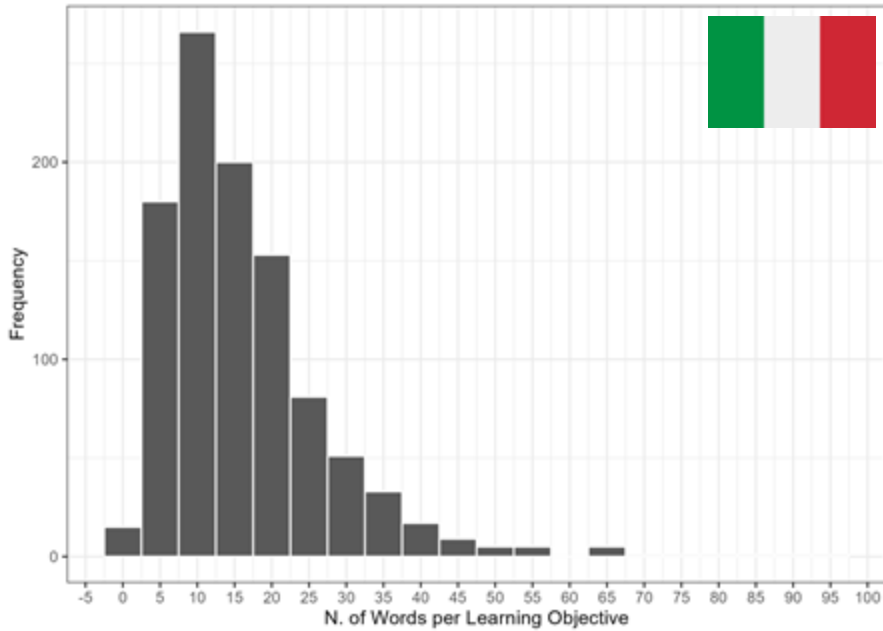


**298**

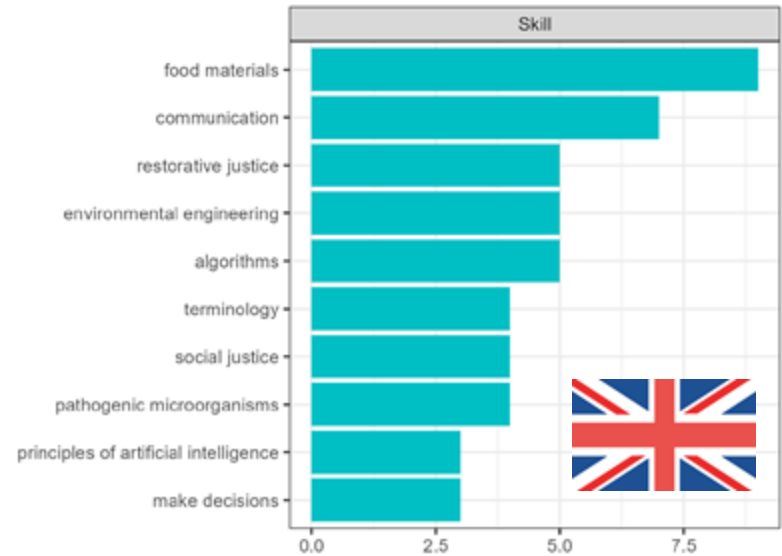
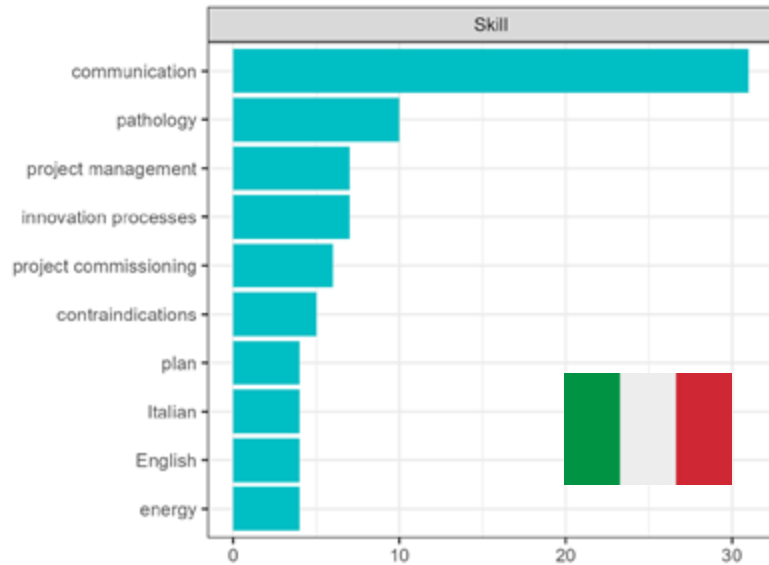
Number of Learning Objectives



# Distribution of Words



# Named Entity Recognition



Number of Learning Objectives

# What do scientific publications tell us about the labor market?



**13,712** Scientific Publications  
TITLE-ABS-KEY("Industry 4.0" OR "Industrie 4.0")

**Extraction Methods**  
**3,322** technologies extracted in papers  
**663** technologies extracted in skills  
Gazetter-based NER approach

**2** versions of ESCO Classification

Chiarello, F., Fantoni, G., Hogarth, T., Giordano, V., Baltina, L., & Spada, I. (2021). Towards ESCO 4.0-Is the European classification of skills in line with Industry 4.0? A text mining approach. *Technological Forecasting and Social Change*, 173, 121177.

# What do scientific publications tell us about the labor market?

4.0 techs in ESCO



4.0 techs missing in ESCO



4.0 techs added in ESCO



4.0 techs missing in papers



Chiarello, F., Fantoni, G., Hogarth, T., Giordano, V., Baltina, L., & Spada, I. (2021). Towards ESCO 4.0-Is the European classification of skills in line with Industry 4.0? A text mining approach. *Technological Forecasting and Social Change*, 173, 121177.

# Which are the topics addressed in Higher Education?



**ESCO** European Classification of Skills/Competences, Qualifications and Occupations



**54,535** degrees descriptions  
**92** Italian Universities  
**10** Academic Years

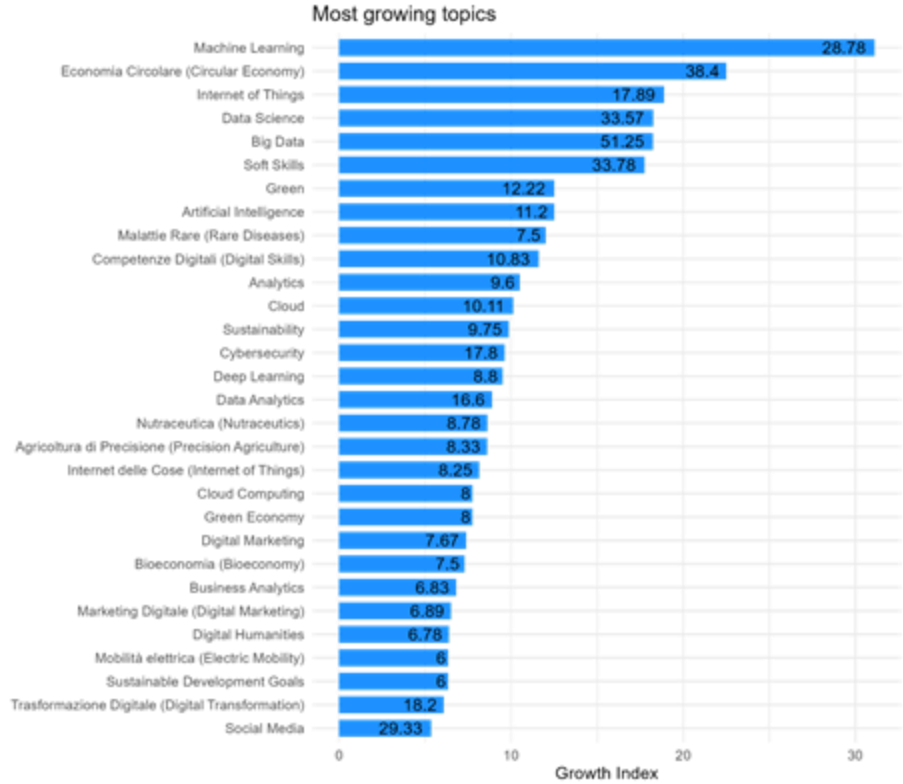
**Extraction Methods**  
**6,062** topics extracted  
Gazetter-based NER approach

**148,082** Topics  
In English and in Italian

Spada, I., Giordano, V., Chiarello, F., Abate, M., Dovetto, F. M., & Fantoni, G. (2023). Tracing topic evolution in higher education: a text mining study on Italian universities. *Studies in Higher Education*, 1-19.



# Which are the topics addressed in Higher Education



Discover more in the app



<https://ispada.shinyapps.io/AppTopicUni/>

Spada, I., Giordano, V., Chiarello, F., Abate, M., Dovetto, F. M., & Fantoni, G. (2023). Tracing topic evolution in higher education: a text mining study on Italian universities. *Studies in Higher Education*, 1-19.

# How aligned are the Degree Courses and the Labour Market?



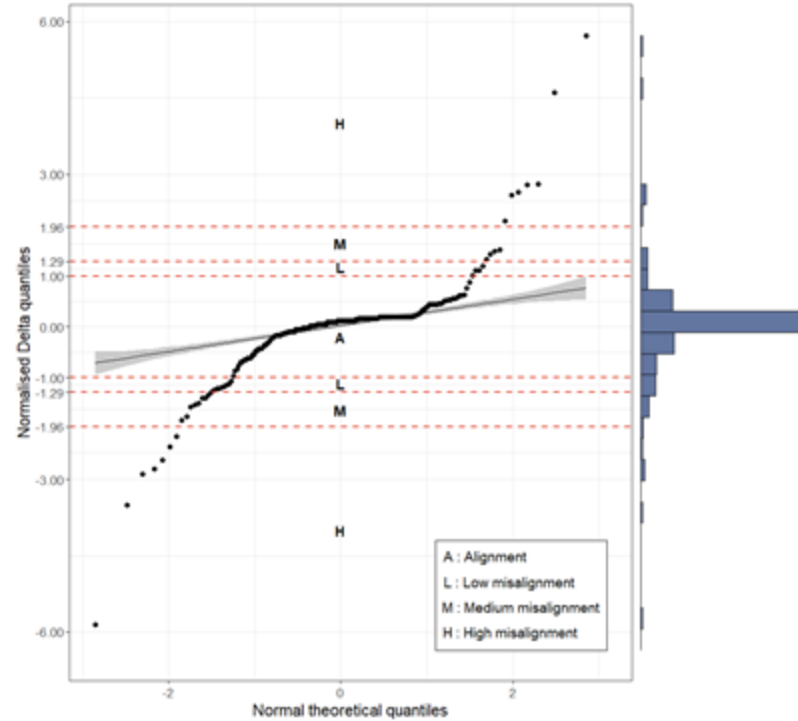
**300** universities  
programmes  
in the Marketing field

**Extraction Methods**  
**230** skills extracted  
Gazetter-based NER approach  
Rule-based NER approach  
Semantic similarity

**950** job vacancies  
in the Marketing area

Spada, I., Chiarello, F., Barandoni, S., Ruggi, G., Martini, A., & Fantoni, G. (2022). Are universities ready to deliver digital skills and competences? A text mining-based case study of marketing courses in Italy. *Technological Forecasting and Social Change*, 182, 121869.

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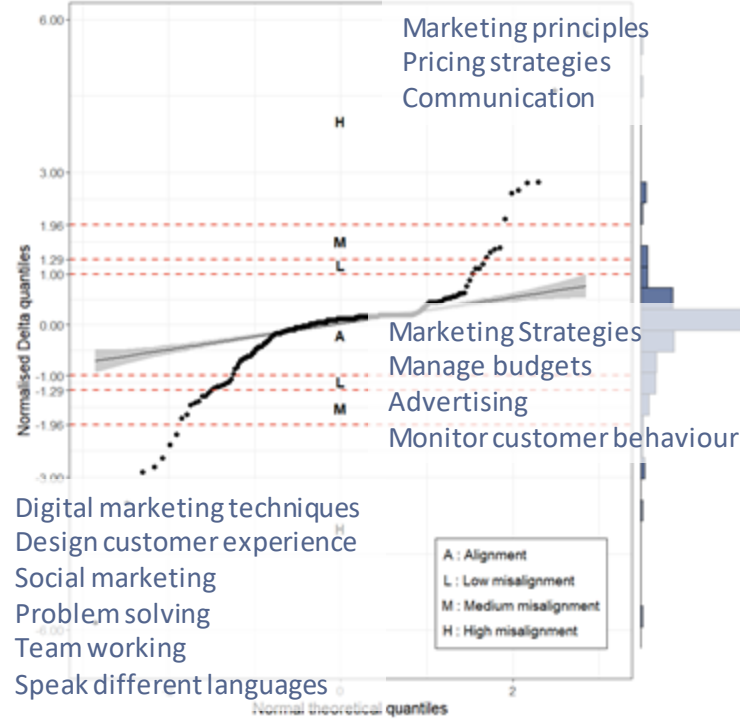
More relevant in education



More relevant in labor market

Spada, I., Chiarello, F., Barandoni, S., Ruggi, G., Martini, A., & Fantoni, G. (2022). Are universities ready to deliver digital skills and competences? A text mining-based case study of marketing courses in Italy. *Technological Forecasting and Social Change*, 182, 121869.

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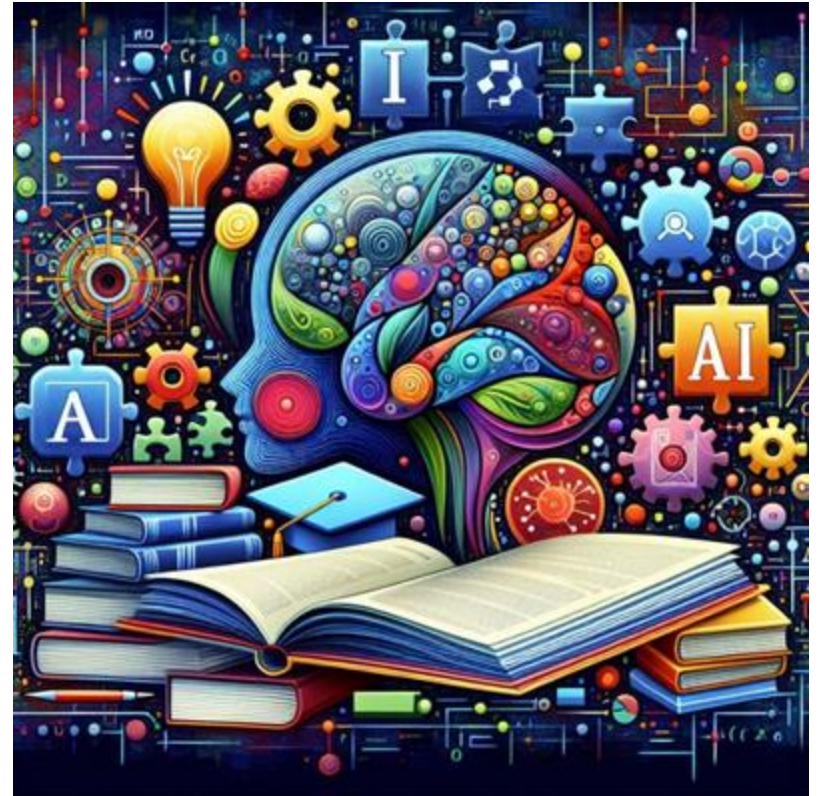


More relevant in labor market

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# Take-away

- ❑ Leverage on data-driven approaches for investigating challenges of AI in education
- ❑ Provide data-driven evidences for supporting educational providers
- ❑ Boost awareness and understaing among stakeholders for facing the Gen-AI edge





# Thank you for your attention



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