

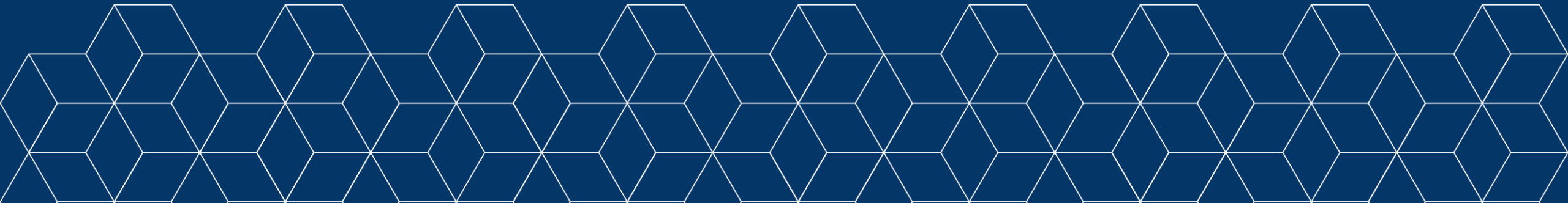
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# ADDRESSING THE SKILL MISMATCH USING GENERATIVE AI

Building a GenAI Model for Education, Training and Labour Market in Italy

Work 2025 - Work in the era of unruly AI

Turku, 20-22 August 2025



# CONTENT

**SKILLS MISMATCH OVERVIEW**

**RESEARCH DESIGN**

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# SKILLS MISMATCH OVERVIEW

## Skills Mismatch: A Global Challenge with Local Impact

 **Global Impact:** 2 out of 5 workers affected **1.3 billion worldwide**

 **European Context:** **around 30% of European employees are mismatched**

 **Italian Specificity:** approximately 1.6 million job vacancies were difficult to fill, due to a shortage of suitable candidates or adequate skills



# RESEARCH DESIGN

## Can Generative AI be trusted for rigorous scientific research in workforce development?

**1 Phase 1 (2023):**  
ChatGPT-3.5 testing and limitation identification

**2 Phase 2 (2025):**  
Frontier Models evaluation with advanced methodologies

### Methodology:

✓ **Rigorous fact-checking**

Multiple validation layers

✓ **Accuracy assessment**

Systematic evaluation

✓ **Institutional data validation**

ISTAT, INAPP, ESCO

### Longitudinal Study Design

Same research questions across different technological generations



# PHASE 1 (2023) THE REALITY CHECK

- Domain Knowledge Gaps
- Knowledge Base Obsolescence
- Artificial Hallucinations



# PHASE 1: THE REALITY CHECK



## Domain Knowledge Gaps:

ChatGPT misidentified Italy's CP2011 as European economic classification. Actually it's the Italian professional classification system.  
**Could invalidate any skills analysis.**



## Knowledge Base Obsolescence:

September 2021 training cutoff created dangerous temporal gaps. Recommended closed training centers in Rome with detailed addresses. Provided course descriptions for non-existent services.



## Artificial Hallucinations:

Generated fabricated academic references with plausible titles and authors. Created fake DOI numbers that led nowhere.

**Severe risks for evidence-based policy making.**

## Critical Failure Modes Identified

Scientific rigor demanded systematic evaluation of GenAI limitations



# PHASE 2 (2025) BREAKTHROUGH RESULTS

- The Improvement Journey
- Model Selection & Training
- Practical Applications & Validation
- Mismatch Analysis



# PHASE 2: BREAKTHROUGH RESULTS

## The Improvement Journey

Remarkable progress from 2023 to 2025 through targeted technological advances.



### Chain-of-Thought Reasoning

Step-by-step logical processing for complex classifications. Structured reasoning paths reduce domain knowledge gaps. **Enhanced navigation of occupational systems.**



### RLHF

Systematic feedback from INAPP domain experts. Continuous learning loops for Italian labor market. **Understanding nuances of terminology.**



### RAG

Real-time data from CEDEFOP, INAPP, ISTAT, MUR. Current information instead of static training data. **Solved knowledge obsolescence problem.**



### Benchmark Improvements

15-30% reduction in hallucinations (TruthfulQA). Substantial progress toward reliable AI intelligence. **Quantitative validation of our progress.**

## Progress toward fully reliable AI system for skills mismatch analysis

80%

Systematic approach demonstrates targeted improvements deliver measurable results in specialized domains



# PHASE 2: BREAKTHROUGH RESULTS

## Model Selection & Training



### Model Evaluation:

Benchmark scores, training recency  
advanced features, cost-effectiveness



### Selection:

Claude 3.7 Sonnet Pro for  
superior domain performance



### Custom Project Architecture:

Specialized instructions, institutional data integration



### Training Sources:

CEDEFOP, INAPP datasets  
ISTAT classifications, MUR databases



### Methodology:

Expert supervision with  
hybrid human-AI validation

**Comprehensive approach: evaluation, selection, architecture, training, and validation**



# PHASE 2: BREAKTHROUGH RESULTS

## Practical Applications & Validation



### Fact-checking Protocol:

Cross-validation with:

- INDIRE (ITS Academy monitoring)
- Unioncamere-Excelsior (employer demand surveys)



### Accuracy Assessment:

Systematic comparison of model outputs with official statistics



### Bias Identification:

Detection of model preferences for non-representative data sources



### Quality Assurance:

Multi-layer validation with domain experts

## Comprehensive Validation Framework

Ensuring reliability and accuracy through systematic multi-source verification



# PHASE 2: BREAKTHROUGH RESULTS

## Mismatch Analysis

Three-case study comparison table with GPT match scores

### Gap Types Identified:

1 

#### Instrumental Gap

Data Analyst case

**GPT match: 0.5**

Solid theoretical foundation,  
missing specific tools  
(SQL, Power BI)

#### Solution:

Targeted 40h SQL + 60h Power BI

2 

#### Technological Gap

Software Developer case

**GPT match: 0.6**

Strong algorithmic base,  
outdated technology stack

#### Solution:

Bootcamp + industry certifications  
+ practical experience

3 

#### Paradigmatic Gap

Digital Marketing case

**GPT match: 0.3**

Fundamental approach  
transformation required

#### Solution:

Comprehensive retraining with  
industry-standard certifications

### Gap Analysis Results

Lower GPT scores indicate greater skills mismatch requiring more intensive interventions



# CONCLUSIONS AND FINAL CONSIDERATIONS

- Future Perspectives
- Challenges and Ethical Considerations



# FUTURE PERSPECTIVES



## For VET Systems:

Differentiated intervention design based on gap typology



## For Policy Makers:

Data-driven decision support with real-time labor market intelligence



## For Individuals:

Personalized career guidance with precise competency mapping





## For Society:


Reduced skills mismatch and improved labor market efficiency




# CHALLENGES AND ETHICAL CONSIDERATIONS

 **Data Bias and Representativeness:**  
Risk of perpetuating existing labor market inequalities

 **Algorithmic Transparency:**  
Need for explainable AI in public policy applications

 **Privacy Protection:**  
GDPR compliance in processing CV and career data

 **User Training Requirements:**  
Essential competencies for effective human-AI collaboration

**Responsible AI Implementation: Balancing Innovation with Ethical Safeguards**





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