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AI, Microlearning, and the Social Fabric of Lifelong Learning. Opportunities and Inequalities in the Italian Context

ESA – International Conference - TECHNOLOGY, ARTIFICIAL INTELLIGENCE AND EDUCATION TOWARDS THE FUTURE OF LEARNING

Link Campus University Rome, 26-27 February 2026

1.Introduction

Placement in the contemporary scientific debate

- Rapid expansion of **Artificial Intelligence** in education and training systems;
- Growing diffusion of **microlearning** formats and **AI-supported** training and tutoring in lifelong learning;
- Training increasingly **mediated by digital platforms**, data infrastructures, and algorithms;
- **Central sociological tension**: innovation, governance, and inequalities.

Relevance of the topic

Social, institutional, and economic relevance

Social: unequal access to learning opportunities, recognition, and upskilling

Institutional: reconfiguration of pedagogical authority, certification, and responsibility

Economic: skills development linked to employability, productivity, and work organisation

Transdisciplinary connections

Policy: lifelong learning strategies, AI regulation, skills agendas

Technology: algorithmic systems, datafication, learning platforms

Organisations: enterprises as key actors in adult education provision

Key concepts and definitions

Artificial Intelligence (AI): *The EU AI Act defines "AI system" rather than "Artificial Intelligence" to provide a precise, operational, and legally enforceable scope for regulation:* '**AI system**' means a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments;

Microlearning: short, modular, and goal-oriented learning units (Hug, 2005), designed to support flexible and incremental skill development.

Lifelong Learning (LLL): learning activities spanning the life course, embedded in social, institutional, and labour-market contexts (Jarvis, 2024).

Digital inequalities: structurally produced differences in access, skills, uses, and outcomes of digital technologies, including algorithmic visibility and recognition (van Dijk, 2020).

2.Theoretical Background

- Networked knowledge reconfiguration (Castells, 2023).
- AI ethics, transparency, epistemic asymmetries (Floridi, 2023).
- Adult education for equity/justice amid tech transformations (Slowey et al., 2024).

Relevant explanatory models

- Sociotechnical transformation of education and training (Butera & De Michelis,2024).
- LLL, while formally open to all, can reproduce social inequalities (Bourdieu, 1986).
- Digital inequalities as stratified access, use, and outcomes (van Dijk, 2020).

3.Research questions and objectives

RQ1 – **AI diffusion in CVET** - How widely is AI used in CVET and adult learning in Italy, and how does its adoption vary by education, age, digital skills, and firm characteristics, in comparison with the EU?

RQ2 – **Microlearning and digitalization** - To what extent is microlearning adopted in CVET, and how is it associated with organisational digital innovation and access to flexible learning?

RQ3 – **Inequality and stratification -** Which educational, digital, and organisational inequalities are reinforced through AI- and microlearning-mediated training?

Overall objective

To assess whether AI and microlearning in CVET foster inclusion or reproduce structural inequalities.

4.Methodology

- Mixed-methods approach, combining: desk analysis, secondary quantitative data analysis.
- Instruments and Data Sources: Policy and regulatory document analysis.
- Quantitative data from: INDACO-Inapp surveys on continuing training and adult learning; Eurostat/Istat.
- Study Scope and Data Analysis:
  - Focus on Italy within a European comparative perspective.
  - Analysis of enterprise training and CVET ecosystems.
  - Sociological interpretation of observed patterns.

5.Main findings

Dimension	Italy	EU / Comparison	Key Inequality Pattern
Digital skills (adults)	54% basic+	60% EU	**Strong education gradient** (low ≪ high)
Training participation (firms 10+)	58.1% (↓)	Fragmented	Firm size & territorial gaps
Low- vs high-skilled participation	10.3% vs 60.2%	Structural	**Cumulative disadvantage**
AI use – adults	>50% (mostly personal)	~30% workers	Age & education divide
AI-mediated learning	35% adults	—	Doubles by education level
AI use – enterprises	16.4% (2025)	Rapid EU growth	**Concentrated in large firms**
Microlearning diffusion	26.4% (+9.6 pp)	Growing	Access expands, outcomes unequal

Authors' elaboration based on INDACO–Inapp and Eurostat data (2025)

5.1 Main findings

Digital skills - Adults with at least basic digital skills *(Eurostat 2025):*
Italy 54% vs EU 60% (2025) → +8.2 pp since 2023

- Strong educational gradient: low-educated adults ≈ **½ of medium** and **⅓ of high-educated**

Training Participation - Italy *(INDACO-Imprese 2025)*:

- 58.1% of firms (10+) provide training (↓ from 63.5% in 2023)

Low-skilled training participation gap: *(Eurostat LFS 2024)*

10.3% vs 60.2% (high-skilled)

Participation Paradox in training:

Those who would benefit most participate least in formal/non-formal training.

5.2 Main findings

AI-mediated learning: *(INDACO Adulti 2025)*

34.7% of adults (18–64)

24.4% low-educated vs 49.7% high-educated

Access ≠ Capability – AI is easy to access, but learning requires digital literacy, soft skills, and guidance.

Microlearning: *(INDACO Adulti 2025)*

Rapid growth: 16.8% → 26.4% (+9.6 pp 2022-2024)

- Expansion across all employment conditions
- Reduction of gap between employed and non-employed

6.Critical Discussion

- The results show that **AI and microlearning** are embedded in broader sociotechnical transformations of lifelong learning, with **differentiated effects** according to education, digital skills, age, and organisational context.
- The findings are consistent with theories of **networked and datafied learning** and with **ethical approaches to AI governance**, highlighting the role of platforms, algorithms, and institutional mediation in shaping learning opportunities.
- The study contributes to sociological debates on **digital education/training and inequality.**

7.Conclusions

- AI and microlearning reshape lifelong learning as a sociotechnical field in which **inequalities are not erased but reconfigured**. Their impact depends less on technological availability than on the social, institutional, and ethical conditions under which they are embedded.

- **Lines for future development**: Longitudinal inclusion studies, ethical governance designs.

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Thank You

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