

Designing the future: AI tools and training support for entrepreneurship and human capital development

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Abstract:

Italy's Inner Areas, such as Capitanata in Apulia, face geographic isolation, demographic fragility, and infrastructural gaps that constrain educational and employment opportunities. This study proposes an evidence-based educational protocol integrating Outdoor Education (OE), Artificial Intelligence (AI), and entrepreneurship education to develop human capital and support socio-economic regeneration. It adopts a longitudinal mixed-methods design in three phases: context analysis, co-design of the protocol following design thinking principles, and implementation with evaluation. Preliminary results from three studies indicate: (1) high perceived effectiveness of OE on motivation, well-being, and transversal skills, alongside logistical barriers and the need for institutional support; (2) teachers report high self-efficacy but low motivation due to frustration of the psychological needs of autonomy, competence, and relatedness, and a strong demand for innovative methodologies; (3) entrepreneurs point to a mismatch between schooling and labor market needs, calling for soft skills, authentic experiences, and systemic inclusion strategies, including for people with disabilities. The protocol aims to personalize learning through AI, leverage territory-based experiences via OE, and translate them into impact-oriented projects through entrepreneurship education, contributing to the SDGs on quality education, reduced inequalities, and sustainable communities.

Keywords: Inner Areas; Entrepreneurship education; Artificial Intelligence in education (List three to five pertinent keywords specific to the article yet reasonably common within the subject discipline.)

1. Introduction

In recent years, the development of Inner Areas has become an increasingly central topic in both scientific and political debates, highlighting the need for innovative strategies to counter phenomena such as geographic isolation, social marginalization, and progressive depopulation. In Italy, the National Strategy for Inner Areas (SNAI) has defined these territories as areas characterized by significant distance from the main hubs offering essential services (education, healthcare, mobility), coupled with demographic, economic, and social vulnerabilities (Lucatelli, 2016). The Capitanata region in Apulia represents an emblematic case: despite being rich in natural, cultural, and landscape resources, it suffers from structural deficiencies that translate into limited educational, occupational, and entrepreneurial opportunities, exacerbating inequalities compared to urban and metropolitan contexts (Barca, 2009).



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The educational and training fabric of these areas faces multiple challenges: on the one hand, ensuring quality education capable of addressing the emerging needs of contemporary society; on the other, bridging the gap between the skills demanded by the labor market and those actually developed by students (OECD, 2020). Furthermore, the reduced attractiveness of these territories and the lack of innovative initiatives contribute to vicious cycles of social and economic impoverishment, directly impacting the capacity of local communities to generate widespread well-being and to attract or retain qualified human capital (Iammarino, Rodríguez-Pose & Storper, 2019).

In this complex scenario, rethinking traditional educational models becomes essential, adopting multidisciplinary approaches and teaching methodologies that integrate knowledge, skills, and transversal attitudes. Educational innovation emerges not only as a lever for individual growth but also as a strategic factor for the economic, social, and cultural revitalization of Inner Areas (Schleicher, 2018). From this perspective, the present study aims to make an original contribution to the scientific debate through the design of an innovative educational protocol currently under development within a multidisciplinary research project. The protocol is based on a critical review of theoretical and empirical literature on the main intervention strategies in peripheral contexts, with particular attention to the potential of Outdoor Education (OE), Artificial Intelligence (AI), and entrepreneurial education.

Outdoor Education, internationally recognized as a pedagogical approach capable of fostering experiential learning in natural contexts, has proven particularly effective in promoting the development of transversal skills, intrinsic motivation, collaboration, and students' psychophysical well-being (Beames, Higgins & Nicol, 2012). However, its impact in Inner Areas remains underexplored, especially in relation to logistical, cultural, and institutional barriers that limit its diffusion.

At the same time, Artificial Intelligence is revolutionizing the field of education, offering new opportunities for personalizing learning pathways, reducing digital divides, and acquiring key 21st-century skills (Luckin et al., 2016). In disadvantaged territories such as Capitanata, AI can serve as a strategic tool to overcome infrastructural deficiencies, enhance access to educational resources, and foster social inclusion, provided it is integrated consciously and ethically into teaching processes (Holmes et al., 2019).

Finally, entrepreneurial education represents a fundamental component in stimulating innovation capacity, autonomy, and initiative among youth, promoting a mindset oriented toward change and the creation of socio-economic value (Gibb, 2002). Based on the principles of design thinking, this type of education encourages empathy, creativity, and iterative problem-solving—crucial elements for addressing the challenges posed by fragile and transitioning territorial contexts (Brown, 2009).

The synergistic integration of these three domains constitutes the innovative core of the proposed protocol: an educational model that, through the use of advanced digital tools, active methodologies, and territorial partnership strategies, aims to strengthen human capital and catalyze socio-economic regeneration processes. Specifically, the protocol focuses on the experimentation of interdisciplinary activities involving students, teachers, and local stakeholders in experiential learning pathways, co-design processes, and critical use of AI technologies, with the objective of addressing the specific educational needs and development potentials of the Capitanata region.

2. Theoretical framework

This study is based on a theoretical framework that integrates three interconnected domains: Outdoor Education, Artificial Intelligence in education, and entrepreneurial education. These domains, when combined synergistically, offer an innovative educational model capable of addressing the educational and socio-economic challenges of Inner Areas. The central idea is that experiential learning in natural settings, enhanced by technology and oriented toward the development of entrepreneurial skills, can serve as an effective strategy to regenerate marginalized territories and promote sustainable development.

Outdoor Education (OE) provides the experiential context in which students can develop cognitive, emotional, and social skills through direct interaction with the natural environment. This internationally established pedagogical approach fosters psychophysical well-being, intrinsic motivation, and problem-solving abilities while promoting a sense of belonging and connection to the territory (Beames, Higgins & Nicol, 2012). However, its potential can be further amplified through the integration of advanced technological tools, such as those offered by Artificial Intelligence (AI). In this context, AI is not merely a technical aid but acts as a catalyst, personalizing learning experiences, adapting them to students' individual needs, and maximizing the benefits of experiential approaches (Luckin et al., 2016).

The combination of OE and AI helps overcome some of the major logistical and institutional barriers that often limit the implementation of Outdoor Education in Inner Areas. For instance, while OE focuses on active and immersive learning, AI can provide tools to monitor progress, identify skill gaps, and offer real-time feedback. Additionally, AI can facilitate connections between the local context and global competencies, bridging the gap between the educational opportunities available in Inner Areas and those in more developed territories (Holmes et al., 2019). This integrated approach not only equips students to face 21st-century challenges but also provides them with tools to critically address the specific issues of their communities.

Complementing these domains is entrepreneurial education, which plays a crucial role in translating the knowledge and skills gained through OE and AI into concrete, value-oriented solutions. Entrepreneurial education, grounded in the principles of design thinking, fosters creativity, empathy, and iterative thinking—essential elements for developing an innovative and change-oriented mindset (Brown, 2009). Through entrepreneurial education, students not only learn to address complex problems but also acquire the skills necessary to identify development opportunities and transform them into sustainable projects that meet local needs (Gibb, 2002).

The synergy among these three domains is evident in their ability to combine theoretical and practical learning, technology and nature, local innovation, and global vision. Outdoor Education provides the immersive experiential context for developing foundational skills; Artificial Intelligence enhances and personalizes the learning process, making it accessible and adaptable; and entrepreneurial education transforms these experiences into concrete actions aimed at territorial regeneration. In this way, students not only acquire technical and transversal skills but also develop critical awareness and social responsibility, empowering them to become active agents in the development of their communities.

This theoretical framework aligns closely with the United Nations' Sustainable Development Goals (SDGs), particularly those related to quality education, reducing inequalities, and promoting sustainable communities (United Nations, 2015). The synergistic integration of OE, AI, and entrepreneurial education not only fosters the development of human capital but also creates a dynamic and contextualized educational ecosystem capable of addressing the specific needs of Inner Areas. Ultimately, this perspective goes beyond improving educational opportunities; it aims to profoundly transform the social and economic fabric of these territories, driving innovation, cohesion, and sustainability.

3. The Design of an Evidence-Based Protocol

The adoption of an evidence-based protocol is essential to ensure that educational interventions are effective, replicable, and adaptable to specific contexts. In Inner Areas, characterized by complex challenges such as geographic isolation, infrastructural deficiencies, and limited educational opportunities, basing decisions on empirical data allows for the optimization of available resources and the maximization of intervention impacts. Scientific literature highlights that an evidence-based approach reduces uncertainty during the planning phases, improves decision-making processes, and promotes the adoption of innovative educational practices aligned with territorial needs (Slavin, 2002; Davies, 1999).

In this context, the development of an educational protocol for Inner Areas must be guided by both a deep understanding of local characteristics and needs as well as scientific evidence regarding the effectiveness of the chosen educational methodologies. Previous studies have demonstrated that integrated approaches such as Outdoor Education, the use of Artificial Intelligence, and entrepreneurial education can have a positive impact on cognitive skills, intrinsic motivation, and the development of transversal competencies (Beames, Higgins & Nicol, 2012; Holmes et al., 2019; Gibb, 2002). However, achieving concrete and sustainable results requires a methodological framework capable of systematically evaluating the effectiveness of interventions.

3.1. Protocol goals and implementation phases

The educational protocol developed in this study aims to address the specific needs of Inner Areas by integrating evidence-based practices to promote human capital and catalyze the socio-economic regeneration of the territory. The strategic objectives include:

1. Bridging the educational and digital divide: by leveraging Artificial Intelligence tools to personalize and enhance learning experiences.
2. Promoting transversal competencies: such as problem-solving, collaboration, adaptability, and entrepreneurial capacity to tackle contemporary challenges.
3. Increasing motivation and self-efficacy: through experiential and innovative approaches that actively engage students.

4. Facilitating connections between schools and local communities: by creating a dynamic learning ecosystem that values local resources and fosters social cohesion.

The protocol's implementation is structured into three main phases, designed iteratively and interconnectedly:

1. Context and needs analysis: This initial phase focuses on collecting and analyzing data on the educational, socio-economic, and cultural conditions of Inner Areas. Using mixed methods (quantitative and qualitative), the aim is to identify the strengths and specific challenges of the territory, with particular attention to the Capitanata region.
2. Educational protocol design: Based on the evidence collected, the protocol is developed by integrating three key domains: Outdoor Education, Artificial Intelligence, and entrepreneurial education. The design process follows design thinking principles, ensuring an iterative and user-centered approach.
3. Intervention and evaluation: The intervention will be implemented over a defined period and assessed through a longitudinal mixed-methods research design that combines quantitative and qualitative measures to evaluate the proposed approach's effectiveness.

3.2. Research methodology

All figures and tables should be cited in the main text as Figure 1, Table 1, etc.

The study adopts a longitudinal mixed-methods approach, integrating quantitative and qualitative methodologies to gain a comprehensive and multidimensional understanding of the phenomenon under investigation. This research design is particularly suited to studying the complex contexts of Inner Areas, as it combines the objectivity of quantitative data with the interpretative depth of qualitative data (Creswell & Plano Clark, 2011). The research consists of three interconnected phases: context and needs analysis, educational protocol design, and intervention and evaluation. Currently, the study is in Phase 1, dedicated to the preliminary context analysis.

The primary objective of the analysis phase is to collect empirical data that will:

1. Examine the educational and socio-economic conditions of Inner Areas, with a specific focus on the Capitanata region.
2. Identify the specific needs of teachers, students, and local communities, focusing on innovative methodologies such as Outdoor Education, Artificial Intelligence, and entrepreneurial education.
3. Assess the structural and institutional barriers hindering the implementation of innovative educational approaches.
4. Inform the educational protocol design, ensuring its adaptability and relevance to the local context.

The context analysis phase employs an exploratory sequential design, a variant of the mixed-methods approach that begins with qualitative data collection followed by quantitative analysis. This approach generates hypotheses and insights from qualitative data, which are then validated and expanded through quantitative analysis (Plano Clark & Ivankova, 2016). Phase 1 is organized into three main components:

1. Qualitative data collection: Semi-structured interviews and focus groups were used to explore the experiences and perceptions of local stakeholders, including teachers, students, and entrepreneurs.
2. Quantitative data collection: Standardized questionnaires were administered to a representative sample of teachers and students to measure key variables such as motivation, self-efficacy, perceptions of innovative methodologies, and perceived barriers.
3. Integrated analysis: Qualitative and quantitative data were analyzed complementarily to identify trends, correlations, and critical aspects, ensuring a holistic and multidimensional understanding of the context.

3.3. Results of Study 1

A quantitative survey conducted with 28 teachers highlighted the perceived effectiveness of Outdoor Education (OE) in improving students' motivation and well-being, with average ratings of 4.7 (SD = 0.4) and 5.5 (SD = 0.3), respectively. However, the study also revealed significant logistical barriers and the need for robust institutional support to facilitate the implementation of Outdoor Education. The study investigated the effectiveness of OE as an innovative teaching methodology applied in an interdisciplinary context within the Inner Areas of the Subappennino Dauno. The findings indicate that OE can serve as an effective tool for promoting learning, psychophysical well-being, and the development of transversal skills, despite the persistence of logistical and organizational challenges. Participants' perceptions of OE were highly positive, with high scores regarding its ability to enhance learning ($M = 5.5$; $SD = 0.3$), foster student engagement ($M = 5.4$; $SD = 0.3$), and improve psychophysical well-being, both for students ($M = 5.5$; $SD = 0.3$) and teachers ($M = 5.3$; $SD = 0.4$). Additionally, OE was perceived as a methodology capable of facilitating interdisciplinary application, bridging theory and practice through contextualized and authentic activities. Participants emphasized that OE promotes the development of transversal skills such as critical thinking, problem-solving, and collaboration ($M = 5.4$; $SD = 0.3$), which are recognized as fundamental in addressing contemporary educational challenges and align with the European Commission's *EntreComp* framework (European Commission, 2016). The data collection tools included a tailored questionnaire designed to investigate the perception of OE in terms of effectiveness, applicability, and its impact on well-being. This instrument, consisting of 19 items evaluated on a six-point Likert scale, enabled a detailed analysis of teachers' opinions regarding the potential of OE as a teaching methodology. A critical aspect that emerged from the study concerns the logistical barriers reported by participants, including difficulties in managing outdoor activities ($M = 4.8$; $SD = 0.5$) and organizing the resources required for the systematic implementation of OE. These findings suggest that ensuring sustainable and widespread adoption of OE requires greater institutional support, both in terms of specific teacher training and the provision of material and infrastructural resources. Furthermore, participants highlighted the importance of detailed planning and effective coordination among schools, families, and local communities to overcome logistical challenges and promote OE as an integrated educational practice within school curricula (Schenetti et al., 2015). Overall, the study's results confirm the potential of OE as an interdisciplinary methodology capable of addressing the educational needs of Inner Areas while leveraging their natural and cultural resources. However, to maximize the positive impact of OE, it is

essential to address the organizational challenges identified and to advocate for a systemic approach that integrates OE into long-term educational policies.

3.4. Results of Study 2

A cross-sectional study conducted with a sample of 58 teachers provided significant insights into the perceptions and educational needs of this specific context. The results revealed a high level of perceived self-efficacy among teachers ($M = 4.6$; $SD = 0.4$), indicating confidence in their ability to manage classrooms, design effective teaching activities, and address educational challenges. However, relatively low work motivation emerged, attributed to the unmet satisfaction of basic psychological needs such as autonomy, competence, and relatedness, as outlined by the Self-Determination Theory (Deci & Ryan, 2000). This condition suggests that while teachers perceive themselves as competent in their roles, the lack of adequate institutional support and a favorable working environment negatively impacts their intrinsic motivation. The study also highlighted a strong demand for innovative teaching methodologies, with 70% of teachers expressing interest in adopting Inquiry-Based Learning and 50% in Digital Storytelling, both recognized for their potential to promote active learning, critical thinking, and creativity. These findings emphasize the need to integrate innovative approaches into the school context to enhance teaching effectiveness and address contemporary educational demands. The analysis was conducted using specific instruments to investigate the constructs of interest. The Teacher Self-Efficacy Questionnaire (QAI) was employed to measure teachers' perceptions of their abilities in areas such as classroom management, instructional design, and collaboration with colleagues and families (La Marca & Di Martino, 2021). The results confirmed high levels of self-efficacy ($M = 4.6$; $SD = 0.4$), which represents a critical factor for the implementation of effective educational practices. The Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) was utilized to evaluate the satisfaction and frustration of the fundamental psychological needs of autonomy, competence, and relatedness (Liga et al., 2018). The results revealed significant frustration of these needs, confirming their negative impact on teachers' work motivation. Finally, an ad hoc questionnaire on innovative methodologies was used to explore teachers' perceptions and interest in modern pedagogical approaches, such as Inquiry-Based Learning and Digital Storytelling. This tool highlighted the need for continuous professional development on innovative practices capable of enhancing student engagement and fostering active and interdisciplinary learning. The findings of this study underscore the importance of targeted interventions to meet teachers' psychological needs and promote innovative methodologies. While teachers perceive themselves as competent in their roles, the working environment requires greater institutional support to improve motivation and facilitate the adoption of modern teaching strategies. Investing in continuous professional development and providing adequate resources are essential steps to ensure stimulating learning environments and address the educational challenges of Inner Areas.

3.5. Results of Study 3

The study conducted during Futura Expo 2025, involving 21 entrepreneurs from various productive sectors in Apulia, explored perceptions regarding the role of schools in developing transversal skills, the challenges of school-to-work transition, and the conditions for workplace inclusion of individuals with disabilities, with a

specific focus on the context of Inner Areas in Apulia. The findings underscored the critical importance of transversal skills as fundamental elements for employability and entrepreneurial development in territories characterized by limited service accessibility and specific productive peculiarities typical of Inner Areas. The entrepreneurs identified essential skills such as socialization, collaboration, adaptability, problem-solving, and effective communication. However, these skills were often reported to be underdeveloped among young people, attributed to an educational system perceived as overly theoretical and insufficiently practice-oriented. This deficiency is particularly problematic in Inner Areas, where the economic fabric requires greater flexibility and adaptability. The school-to-work transition was described as a particularly critical phase in these territories, where the misalignment between educational training and labor market demands is exacerbated by limited access to authentic practical experiences. Entrepreneurs emphasized the importance of internships and apprenticeships that go beyond a merely formal dimension and are designed to integrate theoretical knowledge with concrete operational skills. This aspect is especially relevant in Inner Areas, where the distance from urban centers and the sparse distribution of productive infrastructure often limit opportunities for situated learning, necessitating greater integration between schools, local businesses, and communities. Additionally, entrepreneurs highlighted gaps in young people's abilities to understand business dynamics, manage time effectively, and translate knowledge into operational actions, emphasizing the need to strengthen co-design processes between schools and enterprises, particularly in rural and decentralized contexts. Regarding workplace inclusion of individuals with disabilities, the results revealed an ambivalent situation. On one hand, entrepreneurs recognized the potential added value of cognitive diversity and the specific skills associated with certain disabilities, such as the above-average analytical abilities attributed to individuals on the autism spectrum. On the other hand, cultural and organizational barriers persist, hindering access to employment. These barriers are more pronounced in Inner Areas, where dedicated resources such as assistive technologies and training programs for company personnel are often lacking. Entrepreneurs stressed the importance of systemic interventions, such as job coaching, mentoring, and reasonable workplace accommodations, which should be supported by targeted policies to reduce the gap between labor demand and supply for individuals with disabilities. Data collection was conducted through semi-structured interviews, allowing for an in-depth exploration of the entrepreneurs' perceptions across three main thematic areas:

1. Training and skills development, focusing on critical soft skills for the labor market and the adequacy of school preparation.
2. School-to-work transition, analyzing the balance between practical experiences and theoretical knowledge, with particular reference to the needs of Inner Areas.
3. Inclusion and disabilities, investigating strategies, barriers, and opportunities to promote labor market participation.

The study's findings outline a clear misalignment between educational practices and labor market needs, particularly pronounced in Inner Areas. This context highlights the necessity of targeted interventions to develop transversal skills, promote

authentic practical experiences, and foster workplace inclusion through systemic strategies. In particular, integrating schools with local enterprises, strengthening educational and productive infrastructures, and adopting evidence-based inclusion policies could serve as strategic levers for the sustainable development of these territories. However, the findings require further investigation, considering the qualitative nature of the study and the specificity of the analyzed sample.

4. Discussion and future perspectives

The designed educational protocol represents an innovative and multidimensional intervention aimed at addressing the educational, social, and economic challenges of Inner Areas, with a specific focus on the Capitanata region. Following the contextual analysis phase, the emphasis will shift toward the design and implementation of concrete actions, grounded in scientific evidence and oriented toward promoting human capital and territorial regeneration. The integrated approach, which combines Outdoor Education (OE), Artificial Intelligence (AI), and entrepreneurial education, is designed not only to address the intrinsic vulnerabilities of these territories (Lucatelli, 2016) but also to foster sustainable educational and occupational opportunities.

The design phase is based on the synergistic integration of three key domains. Outdoor Education was selected as an experiential pedagogical methodology capable of promoting psychophysical well-being, intrinsic motivation, and the development of transversal competencies such as collaboration and problem-solving through direct interaction with the natural environment (Beames, Higgins & Nicol, 2012). However, the design process has accounted for the logistical and institutional barriers that limit the application of this approach in Inner Areas, proposing enhanced support through targeted teacher training and carefully planned activities (Schenetti, Salvaterra & Rossini, 2015). In parallel, Artificial Intelligence has been integrated as a tool to personalize learning pathways, monitor progress, and reduce digital divides. The AI platforms designed for this protocol allow for content adaptation to individual needs, providing real-time feedback and enhancing the effectiveness of experiential learning (Luckin et al., 2016; Holmes, Bialik & Fadel, 2019). Entrepreneurial education represents the third pillar of the protocol and serves as a strategic component to foster autonomy, creativity, and innovation among young people. Grounded in design thinking principles, this element encourages students to develop a mindset oriented toward change and the creation of socio-economic value (Gibb, 2002). The design includes simulation activities and project-based learning initiatives that engage local stakeholders to promote concrete solutions for territorial challenges and strengthen social cohesion (Barca, 2009). A participatory approach, involving schools, families, businesses, and institutions, is considered crucial to ensuring the local relevance of the proposed interventions.

During the implementation phase, the protocol will be applied in pilot school settings within Inner Areas. The initial operational phase involves teacher training through workshops and specific activities to ensure the acquisition of the necessary skills to integrate OE, AI, and entrepreneurial education into educational pathways. This step is critical to overcoming the cultural and operational resistance that often hinders the adoption of innovative methodologies (Schenetti, Salvaterra & Rossini, 2015). Subsequently, the protocol will be tested in real-world environments, with activities carefully monitored to evaluate student engagement, the development of

transversal competencies, and the impact on well-being. The final phase will focus on evaluating the outcomes using a longitudinal mixed-methods approach. This research design allows for the combination of quantitative and qualitative data to analyze the effectiveness of the interventions and identify areas for improvement (Creswell & Plano Clark, 2011).

The future perspectives of the protocol include its expansion to other schools and communities in Inner Areas, with adaptations to specific territorial needs. Furthermore, the results of the implementation and evaluation phases will be used to inform educational and territorial policies, encouraging investments in infrastructure and innovative technologies. A crucial objective will be the construction of a self-sustaining educational ecosystem, where collaboration between local actors and national institutions promotes long-term sustainability.

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