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ENTREPRENEURIAL AND DIGITAL COMPETENCIES IN HIGHER EDUCATION: AI INTEGRATION, EXPERIENTIAL LEARNING, AND ETHICAL CONSIDERATIONS

Abstract

Entrepreneurial and digital skills have become core graduate competencies in contemporary knowledge economies. Universities are therefore under pressure to redesign their educational practices in order to prepare students for technology-rich, uncertain and innovation-driven environments. This article provides a concise overview of key conceptual frameworks for entrepreneurial and digital competence and examines several innovative approaches used in higher education, including university startup accelerators, digital skills bootcamps, cross-institutional collaborative projects and the integration of artificial intelligence (AI) into teaching and learning. The paper highlights the UniStartApp accelerator model and interdisciplinary projects in health education as illustrative cases. It also discusses sustainability and ethical issues, such as data protection, equity of access, algorithmic bias and the pacing of innovation. The article argues that entrepreneurial and digital skills should be understood not only as technical abilities but as context-dependent, relational and ethically embedded capabilities. Implications are drawn for universities that aim to develop coherent ecosystems supporting responsible, AI-aware and sustainability-oriented entrepreneurial learning.

Keywords: entrepreneurial skills, digital competence, startup accelerators, bootcamps, artificial intelligence, higher education

1. INTRODUCTION

Rapid advances in automation, artificial intelligence and digital platforms have reshaped labour markets and intensified demands for graduates who can

think entrepreneurially and act effectively in digital environments (OECD, 2019). Universities are no longer evaluated solely on disciplinary knowledge transfer, but also on their capacity to foster creativity, problem solving, adaptability and innovation.

Entrepreneurial and digital skills are now widely considered transversal, relevant across disciplines rather than confined to business or computer science (European Commission, 2016, 2017). At the same time, AI is changing both how organisations innovate and how students learn. This context has prompted higher education institutions to adopt new pedagogical models and institutional structures aimed at competence development rather than only content delivery.

2. CONCEPTUAL BACKGROUND

The EntreComp framework defines entrepreneurship as the capacity to act upon opportunities and ideas to create value for others in business, social, civic or research contexts (European Commission, 2016). It identifies 15 competences grouped into areas such as opportunity identification, creativity, mobilising resources, coping with uncertainty and learning from experience.

Digital competence, as described by DigComp 2.1, includes information and data literacy, digital communication and collaboration, digital content creation, safety and problem solving (European Commission, 2017). It emphasizes not only technical skill, but critical evaluation of information and responsible use of digital tools.

Both frameworks align with experiential learning theory. Kolb (1984) conceptualises learning as a cycle of concrete experience, reflective observation, abstract conceptualisation and active experimentation. Entrepreneurial and digital education built on these principles requires students to engage in authentic tasks, reflect on outcomes and iteratively improve their solutions.

3. INNOVATIVE UNIVERSITY PRACTICES

3.1 Startup accelerators

University-based startup accelerators provide structured support for early-stage ventures initiated by students and researchers. In Poland, several universities have adopted accelerator models that have supported more than eighty projects in a four-year period (Kopera et al., 2018). The UniStartApp programme is a notable example. It operates in parallel with regular studies and combines programming, analytical and managerial content in a blended format.

UniStartApp consists of three modules: an insight phase focusing on ideation and team formation; a business-modelling phase using tools such as the Business Model Canvas and Lean Startup logic; and a startup-shaping phase, in which teams refine prototypes, receive mentoring and pitch to evaluators. While the primary aim is to support venture development, the programme also serves as a powerful learning environment in which participants build confidence, resilience and practical entrepreneurial competence.

3.2 Digital skills bootcamps

Digital skills bootcamps are intensive, short-term programmes that provide focused training in areas such as programming, data analytics, cybersecurity, AI applications and digital marketing. Typically lasting from four to twelve weeks, they use project-based assignments, peer collaboration and portfolio assessment rather than solely examinations.

European universities increasingly use bootcamps to support reskilling and lifelong learning. A key advantage is accessibility: students from non-technical disciplines can acquire digital competencies without changing their degree programmes. Bootcamp graduates often leave with concrete artefacts—applications, dashboards, analytical reports—that serve as evidence of capabilities in the labour market.

3.3 Cross-institutional collaborative projects

Cross-institutional entrepreneurial projects respond to the complexity of contemporary challenges by bringing together students from different programmes and levels. One example involves students from business, ICT

and health curricula collaborating to identify problems faced by health students and to propose entrepreneurial solutions. A dedicated Google Classroom environment provides instructions, templates and submission channels, while team communication occurs through digital collaboration tools.

Such projects allow students to practise opportunity recognition, teamwork and digital collaboration, while institutions gain insight into structural issues in their own programmes. They exemplify how entrepreneurial education can be simultaneously student-centred and organisationally informative.

4. ARTIFICIAL INTELLIGENCE IN ENTREPRENEURIAL AND DIGITAL EDUCATION

Artificial intelligence is increasingly embedded in both the content and infrastructure of university education. AI-driven tools support adaptive tutoring, automated feedback, intelligent search, language support and data analysis. In entrepreneurial contexts, students use AI to explore market information, generate ideas, analyse competitors, test pricing scenarios and develop prototypes.

Within accelerators such as UniStartApp, AI can assist teams in refining value propositions, simulating business models and drafting investor pitches. In digital bootcamps, AI coding assistants and automated graders help learners debug code and progress at individualised paces. In cross-disciplinary projects, AI-based analytics can support the interpretation of survey data or qualitative feedback.

At the same time, AI is an object of critical study. It raises questions about algorithmic bias, transparency, data governance and labour displacement. Universities are therefore beginning to integrate AI ethics and algorithmic literacy into entrepreneurial and digital curricula, encouraging students to interrogate AI outputs and consider the societal implications of automation.

5. SUSTAINABILITY AND ETHICAL CONSIDERATIONS

Entrepreneurial and digital education has long-term societal implications that go beyond employability. Arogyaswamy (2019) argues that sustainability

should be viewed broadly, encompassing environmental, economic, psychological and social dimensions. Innovations that scale faster than individuals or communities can adapt may generate stress, exclusion or inequity. Universities thus have a responsibility to encourage students to consider the pace and direction of change.

Ethical concerns also arise around data privacy, equity of access, intellectual property and psychological well-being. Digital and AI-rich pedagogies require robust data protection policies and clear consent procedures. Without compensatory measures such as device loans or training support, learning designs that assume high digital readiness may exacerbate inequality. Collaborative projects and accelerators must likewise have transparent guidelines on ownership and benefit-sharing, particularly when commercially viable ideas emerge.

Finally, entrepreneurial education often involves intense workloads, ambiguity and exposure to failure. Ethical practice requires framing failure as a legitimate learning outcome and providing mentoring or support services where needed.

6. CONCLUSION

Universities face significant challenges and opportunities in developing students' entrepreneurial and digital skills. Evidence from initiatives such as startup accelerators, digital skills bootcamps, cross-institutional projects and AI-supported learning environments suggests that competence-oriented, experiential approaches can be highly effective. However, these approaches also introduce new responsibilities related to sustainability, ethics and governance.

Entrepreneurial and digital competencies should therefore be understood as more than technical skills; they are context-dependent capabilities that involve judgement, collaboration and ethical awareness. Institutions seeking to support such competencies need to develop coherent ecosystems that combine structured programmes, interdisciplinary collaboration, AI literacy, and explicit attention to societal impact. In doing so, they can prepare graduates not only to

participate in rapidly changing economies, but also to shape them in more inclusive and sustainable directions.

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