### Research on the Pathways to Enhance University Students' Innovation and Entrepreneurship Capabilities from the Perspective of Digital Empowerment

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Abstract: With the rapid development of digital technologies, upgrading innovation and entrepreneurship education in the digital era has become a critical driver for cultivating university students'innovation and entrepreneurship capabilities. This paper explores the significance and core logic of digital empowerment in enhancing these capabilities, analyzes the challenges under digital empowerment, and constructs a practical pathway for digitally empowered innovation and entrepreneurship education. A four-dimensional enhancement framework proposed: "restructuring educational is models, integrating resource platforms, scenarios, optimizing practical and innovating evaluation mechanisms." The finds study that digital technologies significantly improve students' innovative thinking, cross-disciplinary collaboration, and achievement transformation by breaking spatial-temporal constraints, optimizing resource allocation, and deepening practical engagement.

Keywords: Digital Empowerment; University Students; Innovation and Entrepreneurship Education; Capability Enhancement

#### 1. The Significance of Digital Empowerment in Enhancing University Students' Innovation and Entrepreneurship Capabilities

## 1.1 Stimulating Innovative Thinking and Reshaping Educational Models

With the deepening of the national "mass entrepreneurship and innovation" strategy and the trend of digital transformation, innovation and entrepreneurship education has transitioned from a stage of quantitative accumulation across multiple disciplines to a stage of focusing on comprehensive and qualitative enhancement in its development. Therefore, high-quality development in education cannot be achieved without new models of high-quality innovation and entrepreneurship education. The emphasis of higher education lies in breaking through the bottlenecks of traditional teaching methods in this field and urgently needs to cultivate composite innovative talents with digital literacy Digital technology transcends [1]. the limitations of time and space, providing integrated virtual and real teaching resources and environments, addressing the pain points of insufficient practical scenarios and scattered traditional innovation resources in and entrepreneurship education. and offering students immersive learning experiences. Digital technologies (such as AI and virtual simulation) support customized teaching, personalized learning, and scenario-based practice, utilizing big data to analyze students' skill gaps and thereby providing targeted training. This approach cultivates college students' innovative and interdisciplinary knowledge thinking integration through low-cost trial and error. facilitate cross-disciplinary Digital tools collaboration collaboration through digital platforms, addressing traditional disciplinary barriers, and continuously incubating interdisciplinary innovation and entrepreneurship projects.

## **1.2 Fostering Collaborative Synergy and Building Sustainable Innovation Ecosystems**

In the current era where globalization and technological revolution intertwine, а sustainable innovation ecosystem can no longer rely solely on a single entity or a linear innovation model. The complex challenges of the digital age far exceed the capabilities of any single entity. Therefore, the core logic of today's innovation ecosystem lies in deepening connections and sharing, exponentially amplifying individual creativity within a collaborative network. In terms of innovation and entrepreneurship education space, the

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development of digital technology not only shares and optimizes high-quality educational resources for innovation and entrepreneurship but also provides more funding channels, offering robust support for this type of education. instance, open innovation network For metaverse platforms have established virtual entrepreneurial communities, supporting cross-border team collaboration. In terms of the culture of innovation and entrepreneurship education, traditionally, the culture has, in a sense, become mismatched with the evolving needs of such education in the context of digital empowerment. It must shift towards a cultural ecosystem aimed at cultivating a creative spirit and fostering sustained independent innovation, driving the in-depth development of the culture of innovation and entrepreneurship education [2].

#### 2. Core Logic of Digital Empowerment in Enhancing Innovation and Entrepreneurship Capabilities

The profound value of digital empowerment lies in the bidirectional enhancement of technology capabilities. and Technology drives the development of capabilities, while capabilities propel technological advancements. Technology provides tools and platforms, facilitating resource integration and process optimization. Meanwhile, capability reconstruction, through adaptive evolution at the organizational, individual, and ecological levels, unleashes sustainable momentum for innovation and entrepreneurship. Together, they form a closed loop of "technology empowerment - capability upgrading - value creation," driving innovation entrepreneurship from and an opportunity-oriented approach to systematic and ecological development.

#### 2.1 Technology-Driven Dimension

The infiltration of digital technology not only accelerates the iteration of innovation but also breaks through the traditional ceiling of resources and capabilities in entrepreneurship. Its core logic is embodied in two aspects: Firstly, data intelligence allows digital intelligence technology to analyze the employment market with precision, enabling universities to better align with national strategies and industrial needs. Furthermore, by utilizing big data to analyze students' behavioral profiles, universities can accurately match resources such



as personalized learning recommendations and project risk assessments. Big data and AI technologies convert market demands, user behaviors, and technological trends into structured data, shifting entrepreneurs' decision-making from "intuitive judgment" to "data verification." Secondly, the platform ecosystem involves building open innovation and entrepreneurship cloud platforms and pools" "digital resource integrate to industry-academic-research resources. These platforms high-potential recommend entrepreneurial tracks to college students, reducing information asymmetry risks and optimizing resource allocation efficiency. This makes resources such as capital, technology, sharable and and talent reusable. The technology-driven dimension emphasizes the ternary interaction of "data-platform-people," reshaping the underlying logic of college innovation and students' entrepreneurship technology-driven through efficiency transitions.

#### 2.2 Capability Restructuring Dimension

Digital technology is forcing college students to push beyond the traditional boundaries of their innovative and entrepreneurial capabilities, aiming for a higher level of innovation freedom and forming a symbiotic relationship of "technology adapting to abilities and abilities enhancing technology." This is mainly reflected in three aspects: Leap in Innovative Thinking: Students learn to leverage digital tools (such as AI-aided design and open-source coding communities) to stimulate interdisciplinary innovative capabilities. Mastering digital tools has given birth to digitally literate and multi-skilled talents. Entrepreneurial Practice: Digital new business forms such as e-commerce live streaming and cross-border e-commerce provide low-barrier entrepreneurial testing grounds. Entrepreneurs need to master skills such as data analysis and automation tools, focusing on value creation itself to achieve individual capability transformation. Digital Literacy: Digitization brings risks such as data privacy and algorithmic fairness. Therefore, data security and algorithmic ethics have become essential skills for innovative and entrepreneurial talents. In summary, digital technology is driving college students to innovate and entrepreneurially transcend traditional capabilities, fostering a higher level



of innovation freedom and shaping a symbiotic relationship between technology and abilities.

#### 3. Challenges in Enhancing Innovation and Entrepreneurship Capabilities Under Digitalization

## **3.1 Over-Reliance on Tools vs. Narrowing of Innovative Thinking**

The improper utilization of the editability of digital technology creates certain barriers to innovation and entrepreneurship. The editable, expandable computational features and generative application characteristics of digital technology may lead students into the misconception of "technology as omnipotent." Inappropriately leveraging the editability of digital technology can result in a certain degree of homogenization among college students' creative entrepreneurial projects, diminishing the subjective initiative of students as the primary innovators. Some students view AI as a tool to "replace humans" rather than as a partner to "enhance creativity," leading to a lack of human-machine collaboration skills. Meanwhile, overreliance on digital tools causes students to neglect foundational logical learning, business ethics, and social responsibilities, presenting an imbalance between technological dependency and humanistic literacy. This also gives rise to corresponding legal and ethical issues, hindering the innovative development of college students.

## **3.2 Rapid Technological Iteration vs. Lagging Educational Content**

Currently, digital technology provides crucial means and avenues for innovation and entrepreneurship education in universities; however, students lack real-time and in-depth understanding of the latest developments in digital technology and the technical and product content required for industry applications. Meanwhile, in terms of practical application, most college students lack corresponding skills and experience in market development and business operations, and do not master appropriate business models and operational strategies in the early stages of entrepreneurship [3]. In the digital era, the iteration cycle of digital technology has shortened to six months, while the update cycle of university curriculum systems is long, resulting in a disconnect between the curriculum and industry needs. entrepreneurship Digital innovation and

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education in universities requires the imparting of interdisciplinary knowledge. The disciplinary barriers in universities lead to students who "understand technology but not the real market, and understand business but struggle to use practical tools." True digital innovation and entrepreneurship necessitates the integration of technology, business, and design thinking, focusing on cultivating the core competencies of digital natives—creating value through human-machine collaboration, defining problems in the fusion of virtual and real, and integrating resources within ecological networks. The traditional linear chain of "teaching-learning-application" in universities, combined with the fact that university instructors have not received systematic digital technology training and still use traditional business theories to guide AI and metaverse projects, has led to a lag in the transformation of teachers' roles. Consequently, the innovation and entrepreneurship projects guided by these instructors suffer from a lack of digital innovation model design, making it difficult to transform technology into viable entrepreneurial projects.

#### 4. Pathways to Enhance Innovation and Entrepreneurship Capabilities via Digital Empowerment

Overall, the essence of digital empowerment in enhancing innovation and entrepreneurship capabilities lies in reconstructing the relational network of the "student-project-practice ecosystem" through technology. Therefore, it is necessary to innovate and improve in the following four aspects, seeking a balance between the rationality of technological tools and the humanistic values of education. This involves leveraging digital technology to transcend physical limitations while adhering to educational essence of continuously the "cultivating innovative personalities," ultimately achieving the goal of "digital for the good, nurturing innovative talents."

#### 4.1 Restructuring Educational Models: From "Knowledge Transfer" to "Capability Incubation"

The transformation of educational models in the digital era necessitates a shift from "one-way knowledge impartation" to "dynamic capability incubation." For instance, online education will become the norm in the future, with the model

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of innovation and entrepreneurship education transitioning from offline to online. By leveraging technology to reshape teaching scenarios, reconstruct knowledge systems, and rebuild evaluation standards, a new educational paradigm of "integration of learning and application, fusion of virtual and real, and ecological collaboration" is formed, truly transforming college students from "containers of knowledge" to "subjects of innovation." Firstly, it is essential to reconstruct the digital entrepreneurship curriculum system by aligning with the development requirements of the digital industry, incorporating artificial intelligence and big data into professional talent training programs, and comprehensively developing a interdisciplinary cross-boundary and entrepreneurship curriculum system with digital economy as its distinctive feature [4]. Secondly, an AI-driven personalized learning path should be established. Based on learning behavior data, students' shortcomings in innovation and entrepreneurship skills are analyzed, and AI algorithms dynamically adjust the difficulty and content direction of the courses. Then, online course platforms are utilized to complete basic knowledge learning, while offline classrooms focus on solving real entrepreneurial problems. By constructing a micro-major matrix of "digital technology + industry pain points," establishing interdisciplinary virtual teaching and research sections, and building digital collaboration networks across universities and majors, resources in technology, business, design, and other disciplines are integrated to continuously incubate digital projects. Finally, the "capability incubation" goal within digital training objectives should be clarified, with detailed expressions of college students' core innovative capabilities, emphasizing big data processing and analysis capabilities, innovation capabilities, emotional management capabilities, team collaboration and management capabilities. among others [5].

#### 4.2 Integrating Resource Platforms: From "Fragmented Silos" to "Ecosystem Synergy"

The innovation and entrepreneurship of college students face several pain points in terms of resource platforms. Firstly, resources are fragmented, with entities such as universities, enterprises, governments, and incubators possessing scattered resources and lacking a unified entry point. Secondly, there is



information asymmetry, with inefficient transmission of information on projects, mentors, funding, policies, and high matching costs. Thirdly, services are fragmented, with disjointed links such as course training, practical guidance, and financing connections, lacking full-chain support. The core of digitally empowering the enhancement of college students' innovation and entrepreneurship capabilities lies in breaking the traditional situation of resource decentralization and data silos to build an open, shared, collaborative, and interconnected digital ecosystem. Firstly, by constructing a unified entry for a "four-in-one" digital platform: integrating university knowledge bases (courses, cases), enterprise demand pools (projects, technologies), government policy databases (subsidies, regulations), and social resource pools (funds, mentors), a "cloud platform for innovation and entrepreneurship resources" is Meanwhile, leveraging intelligent created. matching and AI algorithms, precise recommendations for "project-mentor-funding-scenario" are realized, with blockchain technology ensuring credible data sharing. Throughout the full service cycle, digital tools support the entire process from "idea inspiration  $\rightarrow$  project incubation  $\rightarrow$ achievement transformation  $\rightarrow$  commercial landing." Secondly, by establishing a dynamic data mid-platform and a multi-dimensional portrait system to collect student capability data, project growth data, and resource usage data, big data analysis is employed to identify innovation and entrepreneurship trends, issue early warnings for project risks, optimize resource allocation, and provide real-time dynamic monitoring and decision support. Furthermore, a university innovation and entrepreneurship resource alliance chain is established, facilitating resource ecosystem collaboration through university-enterprise integration and

government-industry-academia-research

cooperation. Enterprises can assist innovators in accurately grasping and continuously meeting user needs [6]. A "one-map platform for entrepreneurial resources" and a policy intelligent matching engine are set up, enabling one-click generation of application schemes, with government open data interfaces supporting market analysis. This truly achieves "letting data flow, activating resources, and enabling innovation."



# 4.3 Optimizing Practical Scenarios: From<br/>"Simulation" to "Virtual-Real" Integration"qualitat<br/>throughDigital technology is reshaping the educational<br/>ecosystem and optimizing practical scenarios,4.4 In<br/>From "

ecosystem and optimizing practical scenarios, providing new hybrid virtual-real environments for innovation and entrepreneurship education. Traditional classroom simulation training, with its limited scenarios, constrained resources, and delayed feedback, struggles to meet the complex and authentic innovation and entrepreneurship needs of college students. The deep integration of virtual simulations and real-world scenarios can transcend the limitations of time and space, fostering an innovative practice environment characterized by low-cost trial and error, high immersion experiences, and dynamic feedback. At the beginner stage, college students can utilize digital sandboxes to conduct virtual simulation platform training for business operations and product development processes. At the intermediate stage, they engage in hybrid virtual-real practice by accessing real enterprise data to simulate the full lifecycle management of product projects, subsequently embedding virtual products into real-world scenarios through AR/VR technology. As they advance to the higher stage, a hybrid virtual-real ecosystem is established, featuring decentralized virtual entrepreneurship spaces where tools like ChatGPT generate market analysis reports, providing real-time decision support. Digital technology offers entrepreneurs new processes and methodologies for production and operation in practical scenarios, reducing risks during the entrepreneurial journey [7]. The iteration of practical scenarios from "simulation training" to "hybrid virtual-real coexistence" essentially "student-project-practice reconstructs the ecosystem" relationship in innovation and entrepreneurship education through digital technology. For instance, some universities apply learning big data models for simulation teaching scenarios, knowledge big data models to enhance students' critical thinking skills, and capability big data models to cultivate innovative thinking in education and teaching, thereby enhancing students' insight, critical thinking, and creativity [8]. In the future, further exploration is needed to advance cognitive interaction mechanisms between virtual and real spaces and establish cross-scenario circulation rules for digital assets, ultimately achieving the

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qualitative goal of education empowerment through "strengthening the real with the virtual."

#### 4.4 Innovating Evaluation Mechanisms: From "Result-Oriented" to "Process-Driven Empowerment"

In the traditional evaluation mechanism for college students' innovation and entrepreneurship, there exists single а "result-oriented" approach, which excessively focuses on explicit achievements such as entrepreneurial competition awards, patent counts. and business registrations, while neglecting the implicit growth of core competencies like innovative thinking, team collaboration, and risk response among college students. The innovative opportunities brought empowerment bv digital enable the quantification of process data, where digital platforms can record entrepreneurial activities throughout the entire process, and AI algorithms can analyze and predict projects for early intervention. The "process empowerment" evaluation mechanism involves a shift in evaluation logic from "static results" to "dynamic portraits." On the one hand, this includes multidimensional capability evaluation indicators such as innovative thinking indicators, practical ability indicators, digital literacy indicators, and social responsibility indicators. Human society faces a series of significant challenges, and addressing social and environmental challenges requires college students to possess not only awareness of innovation and entrepreneurship but also a sense of social responsibility [9]. On the other hand, there is innovation in evaluation methods, with digital technology driving full-process tracking. Process data is utilized through virtual simulation platforms to record students' in digital operational paths systems. Collaborative tools dive into analyzing team communication quality and problem-solving efficiency, while biosensing technology detects concentration and emotional fluctuations in innovative activities. This allows for the collection of process data for intelligent analysis and feedback. From the perspective of digital empowerment, the innovation in the evaluation mechanism for college students' innovation and entrepreneurship capabilities needs to break through the traditional single dimension of "result-oriented" and shift towards a "process empowerment" model centered on process

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data-driven, dynamic feedback optimization, and collaboration among multiple entities. Under the perspective of educational digitalization empowerment, the implementation of innovative education not only stimulates students' creativity and cultivates critical thinking and problem-solving capabilities, but also enables them to develop into innovative talents capable of adapting to future societal development [10].

#### 5. Conclusion

Digital technology has not only reconstructed the practical scenarios of innovation and entrepreneurship education but also provided new methodologies for capability enhancement through mechanisms such as resource platform integration, practice scenario optimization, and evaluation mechanism innovation. From the perspective of digital empowerment, the enhancement of college students' innovation and entrepreneurship capabilities involves а transition from "knowledge transmission" to "capability incubation," from "isolated islands" to "ecological collaboration," from "simulated training" to "virtual-real coexistence," and from "result-oriented" to "process empowerment." This shift pushes the focus of digital-era innovation and entrepreneurship education from "final assessment" to "holistic nurturing," transforming college students' innovative and entrepreneurial mindset from "proving success" to "facilitating growth."

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