

Enhancing Entrepreneurial Knowledge and Skills in Business Education through Artificial Intelligence and Machine Learning

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Abstract

Artificial Intelligence-enabled technology for entrepreneurial business education and skills is crucial. It marks a shift from traditional methods to digital modes for delivering knowledge and developing entrepreneurial skills. It offers an innovative way to move from a teacher-centric to a learner-centric approach, enhancing knowledge and improving skills. The study aims to examine the impact of AI-based learning on entrepreneurial business education and skill development, analyse access to AI tools and their impact on startup success rates across India, evaluate the role of digital literacy in improving entrepreneurial education, assess the effectiveness of AI-enabled training platforms in improving learning outcomes for students and aspiring entrepreneurs, and provide recommendations for policymakers on adopting AI, leveraging entrepreneurial business education, and enhancing skills.

Keywords: Entrepreneurial Knowledge, Business Education, Artificial Intelligence, NITI Aayog, MOOCs, Incubators, National Skill Development Corporation.

Introduction

In developed and developing countries, entrepreneurship has emerged as a crucial driver of innovation, employment generation and economic growth. In developing countries such as India, entrepreneurship has played a vital role in addressing structural challenges, unemployment, regional disparities, and the need for inclusive growth. Over the past few decades, entrepreneurial development has shifted from a theoretical approach to a practice-oriented field that emphasises skill development, innovation, and real-world problem-solving. Integrating digital Artificial Intelligence (AI) technologies enables more personalised, data-driven, and scalable approaches to entrepreneurial learning (Kuratko, 2016; Fayolle & Gailly, 2015). The concept initially focused on basic business knowledge, including finance, marketing and management. Later, it shifted to globalisation and technological advancement, with greater emphasis on entrepreneurship in startup ecosystems, and moved toward experiential and competency-based learning models. In India, initiatives such as Startup India, Skill India, and institutional incubation centres have significantly shaped students' and aspiring entrepreneurs' mindsets. These initiatives emphasise innovation, risk-taking, value creation and entrepreneurial outcomes aligned with market needs (Government of India, 2020; NITI Aayog, 2021). In earlier days, AI was a transformative force across industries, including education. AI technologies such as Machine Learning (ML), Natural Language Processing (NLP), and predictive analytics are changing how knowledge is delivered, accessed, and applied. AI-related platforms include tutoring, mentoring, real-time feedback, experiential learning, and practical insights. This study bridges theory and practice by applying theoretical concepts to practical problems that learners solve using skills such as problem-solving, critical thinking, and data-driven decision-making (Luckin et al., 2016; Holmes et al., 2019). This method uses an adaptive learning platform to support entrepreneurship, helping users achieve their goals and build expertise. This learning is crucial for prospective learners, helping them build skills in areas such as business strategies, risk assessment, and data-informed decision-making in a controlled environment. Technology in teaching enhances critical thinking, problem-solving,

and decision-making skills, which are essential for entrepreneurial education and its impact on success (Woolf, 2021). AI also plays a vital role in making innovative decisions based on big data analytics. These entrepreneurs analyse data to identify market trends, consumer preferences, and opportunities, and use these insights to develop innovative products and services that optimise business operations and help them compete with other businesses. AI-based learning supports the development of predictive models for resource allocation, financial planning, and risk management, thereby increasing the scope for startup success (Brynjolfsson & McAfee, 2017).

Despite many advantages, integrating AI and ML into entrepreneurial business education in India faces several challenges. One challenge is the digital divide, i.e., very limited facilities and resources in rural and underprivileged areas. These infrastructure constraints contribute to inadequate internet connectivity, limited access to digital devices, and low digital literacy among learners and trainers in AI-based learning systems (UNESCO, 2021). Another important constraint is data privacy and ethical considerations. Collecting and analysing large volumes of personal data raises concerns about security, consent, and transparency. To protect personal data, separate governance frameworks are essential to building trust among users (OECD, 2021). While AI technology aligns with business education objectives and teaching methodologies, collaboration among AI tools, educators, and stakeholders remains crucial. This system is transforming from a teaching-centric to a learner-centric system. Therefore, policymakers need to develop related frameworks that integrate AI with pedagogical frameworks to support the AI-enabled educational ecosystem and ensure effective learning outcomes. While AI technologies offer significant potential, their impact depends on how well they are aligned with educational objectives and teaching methodologies. Educators must be trained to use AI tools effectively and incorporate them into their teaching practices through collaborative efforts among policymakers, educational institutions, and industry stakeholders (Selwyn, 2019). The present study examines the impact of AI-based learning on enhancing entrepreneurial business education and skill development, analyses access to AI tools and their impact on startup success rates across India, evaluates the role of digital literacy in improving entrepreneurial business education, assesses the effectiveness of AI-enabled training platforms in improving learning outcomes for students and aspiring entrepreneurs, and provides recommendations for policymakers on adopting AI, leveraging entrepreneurial business education, and enhancing their skills. AI-based learning enhances education and skill development. This represents a shift from a traditional to a more sophisticated approach. On a digital platform, it improves learner competencies and builds knowledge in problem-solving, creative thinking, and issue resolution through appropriate decision-making.

AI Tools and Techniques for Enhancing Entrepreneurial Business Education and Skills

S. No	AI Tool / Technology	Key Features	Application in Entrepreneurial Education	Impact on Skills Development
1	Generative AI Tools	Content generation, idea creation, automation	Business plan writing, marketing content, product prototyping	Enhances creativity, innovation, and ideation skills
2	AI-Powered Learning Platforms	Personalized learning, adaptive algorithms	Customized entrepreneurship courses, skill gap analysis	Improves learning efficiency and domain-specific skills
3	AI Chatbots & Virtual Mentors	24/7 support, automated responses	Startup guidance, query resolution, mentoring	Develops decision-making and problem-solving skills

4	Data Analytics Tools	Predictive analytics, data visualization	Market research, customer analysis, financial forecasting	Strengthens analytical and strategic thinking
5	AI-Based Skill Development Platforms	Online training, certification programs	AI, coding, digital marketing, business analytics training	Enhances technical and digital entrepreneurial skills
6	AI + IoT & Robotics	Smart automation, real-time interaction	Practical learning, innovation labs, product development	Improves hands-on and technical innovation skills
7	Edge AI & Research Platforms	Real-time processing, low latency	Startup research, experimentation, innovation projects	Encourages research-oriented entrepreneurial mindset
8	Digital Innovation Ecosystems	Incubation, funding, networking	Startup India programs, AI missions, incubation centers	Promotes entrepreneurial ecosystem development
9	Virtual & Hybrid Learning Systems	Remote access, global connectivity	Online entrepreneurship courses, virtual mentoring	Increases accessibility and global exposure
10	Indigenous AI Platforms	Localized solutions, affordability	AI tools for Indian startups and students	Enhances inclusivity and accessibility

The table clearly indicates that, to enhance entrepreneurship education and skills, the tools and techniques include generative AI tools that provide content generation, idea creation, and automation. These tools support business planning, marketing content, and product prototyping, all of which students will design. They enhance creativity, innovation, and ideation skills. The second AI platform is AI-Powered learning. It uses personalised, adaptive learning algorithms and offers a customised course to help entrepreneurs address skill gaps. This tool improves learning efficiency and domain-specific skills. The third AI skill listed is AI Chatbots and Virtual Mentors. This acts as a 24/7 support system and provides automated responses. Generally, it helps entrepreneurs in the initial stage with startup guidance, query resolution, and mentoring. It also develops decision-making and problem-solving skills. Another tool of AI in education and an entrepreneur's skill is data analytics. These tools provide support for predictive analytics and data visualisation. Using these tools, an entrepreneur can analyse marketing, customer behaviour, and financial forecasting, strengthening analytical and strategic thinking. One more tool is AI-based skill development platforms. These online certification programs cover coding, digital marketing, and business analytics, and enhance technical and digital entrepreneurial skills. Another tool is AI, IoT, and robotics services. This enables smart automation and real-time interaction, leading to practical learning, innovation labs, and product development. It improves hands-on and technical innovation, which will be offered to entrepreneurs. Another AI tool for entrepreneurs is Edge AI and Research Platforms. This tool leads to real-time processing and effective decision-making. Generally, entrepreneurs involved in startup research, experimentation, and innovation projects can use this tool, which encourages a research-oriented entrepreneurial mindset. Tools of Digital Innovation and Ecosystems lead to related facilities, such as incubation, funding and networking. This tool uses those entrepreneurship programs, AI missions, and incubation centres to promote the development of the entrepreneurial ecosystem. Virtual and Hybrid Learning systems, along with this tool, enable remote access and global connectivity. It also offers online entrepreneurship courses and virtual mentoring, providing aspiring entrepreneurs with global exposure. The final tool is Indigenous AI Platforms. It offers localised, affordable solutions

that Indian startups and students can use. This tool enhances inclusivity and accessibility for entrepreneurs.

Review of Literature

The existing literature highlights the convergence of AI with financial decision-making, data analytics, and digital education as a strong foundation for entrepreneurial education and training. The literature review explored AI and entrepreneurial education, broadly divided into four themes. These include AI in Education, AI in Entrepreneurship, Digital Literacy and Economic Impact.

AI in Education: AI-based learning systems provide a body of literature on personalised and adaptive learning experiences. The studies examine the role of tutoring systems, data-driven decision-making, real-time feedback, and improvements in learning outcomes. The literature review began with a theoretical perspective, the Technology Acceptance Model, which examines how AI tools are perceived in terms of usefulness and ease of use, and how they are adopted for learning. Additionally, Constructivist learning theory supports the idea that AI facilitates active, experiential learning by allowing students to engage with real-world problem-solving scenarios. Recent studies have primarily focused on AI's role in transforming teaching and learning, particularly in business and entrepreneurial education. AI-enabled tools are adaptive learning systems that use intelligent tutoring and data analytics to enable personalised learning with real-time feedback. Empirical studies suggest that AI-enhanced learning environments improve engagement and skill acquisition (Lucken et al., 2016; Holmes et al., 2019). AI & ML models can identify nonlinear relationships in data, improving forecasting accuracy and decision-making (Jordan & Mitchell, 2015). These developments demonstrate how AI can significantly improve market efficiency, liquidity, and profitability (Aldridge, 2013; Christalla, 2011).

AI in Entrepreneurship: Related studies help entrepreneurs analyse market trends and consumer behaviour and optimise business strategies. These studies enhance decision-making and reduce risk. Behavioural finance theories highlight cognitive biases and irrational behaviour in financial decision-making (Daniel Kahneman & Amos Tversky, 1979). Integrating behavioural insights with technological tools can improve financial and entrepreneurial outcomes (Barberis & Thaler, 2003; Statman, 2014). The Efficient Market Hypothesis, a concept in financial markets that highlights market efficiency, will influence investment decisions (Fama, 1970). Researchers have studied the integration of AI in financial markets extensively in recent years. Business intelligence (BI) tools help companies quickly generate insights that guide managers toward operational efficiency, opportunity recognition, and competitive positioning (Mano Ashish Tripathi et al., 2023).

Digital Literacy: Digital literacy is critical to adopting and using AI technologies. The aspiring entrepreneur's high level of digital literacy leads to better learning outcomes and increased entrepreneurial success. In the modern era, digital platforms have played a vital role in improving students' learning outcomes. AI applications are reshaping the landscape, and continuous improvement in knowledge and education is required to meet the demands of a dynamic environment and technological change (Brynjolfsson & McAfee, 2017). AI applications in business education, such as banking, insurance, and financial services, meet customer requirements and enable real-time decision-making (Vyas, 2024; Doshi, 2025). Based on learners' digital literacy and willingness to adopt AI technology for the development of their skills (Viswanath Venkatesh et al., 2003). Innovative technologies, such as AI and ML, can be used in derivatives markets to enhance market efficiency and support decision-making (Rani & Gupta, 2025; Rai & Shekhar, 2025; Kanaparthi, 2024; Sambasivan et al., 2021). Other studies use AI for predictive analytics to improve accuracy and reduce uncertainty in financial markets (Vancsura et al., 2025). AI adoption in educational and entrepreneurial ecosystems supports digital infrastructure, data availability, and skill development (Senthil Kumar et al.,

2025). AI in financial markets enhances algorithmic trading, portfolio optimisation, and risk management (Srivastava & Sikroria, 2024). Similarly, AI algorithms execute trades at high speed and exploit market inefficiencies. Machine Learning (ML) techniques are widely used to forecast market risk in the stock market, and AI-based models predict stock price movements (Jain & Vanzara, 2023). While Gao et al. (2024) and Cao et al. (2024) focus on AI-driven financial risk prediction. Similarly, ML algorithms and statistical models assess data accuracy and adaptability. Additionally, data mining techniques for fraud detection demonstrate AI's ability to identify anomalous patterns and mitigate financial risks (Ngai et al., 2011; Bhasin, 2016). Related studies, such as those examining AI's impact on learning outcomes and entrepreneurial performance, used both quantitative and qualitative research and multivariate analysis (Hair et al., 2019; Montgomery, 2017). AI-enabled applications in entrepreneur education and skills have faced several challenges, including privacy, data security, transparency, and ethical considerations (Sambasivan et al., 2021).

Economic Impact: AI-based education contributes to economic growth by enhancing productivity, innovation and generating employment opportunities. From a technological perspective, AI integrated with advanced hardware enabled the development of high-performance computing architectures and advanced reconfigurable computing (Mead & Conway, 1980; Rabey et al., 2003; Tessier & Burleson, 2001). More recent studies by Sze et al. (2017) and Chen et al. (2016) focus on energy-efficient neural network processing, which is more helpful for real-time AI applications. Advanced AI&ML-integrated hardware technology is used in the financial market to analyse data and large-scale datasets, helping investors make accurate decisions and improve their wealth (Samineni et al., 2021). Therefore, future research should focus on developing inclusive, sustainable AI-driven educational models that bridge existing gaps and promote the adoption of innovative technologies to meet requirements and seize opportunities to enhance entrepreneurs' education and skills.

Research Problem: This study examines the influence of AI-based learning on business education and skills and how these, in turn, influence startup success. Most studies have explored domains such as financial markets, automation, and data analytics, but research on AI-based learning in entrepreneurial education remains limited. Most prior studies adopt a theory-based conceptual approach and examine AI's impact on improving learning outcomes. However, in the Indian context, the major challenges include disparities in digital access in rural areas, infrastructure limitations, and differences in educational quality across regions. AI-based learning and real-world implementation can address these problems, enabling aspiring entrepreneurs to tackle a range of practical challenges. This study focuses on AI adoption and assesses measurable outcomes such as skill enhancement, digital literacy, and startup performance. Existing studies often focus on isolated variables and fail to account for how they affect entrepreneurial ecosystems. This study bridges the gap by linking AI-based learning to improved entrepreneurial outcomes and using digital literacy as a mediating variable to explain access to technologies.

Research Gap: Despite a broad review of the literature on AI integrated with entrepreneurial business education and skills, i.e., the transformation towards digital, some critical research gaps remain, particularly in the Indian context. Based on a literature review, existing studies focus on AI in financial markets, algorithmic trading, and predictive analytics; they overlook entrepreneurial education and skill development (Brynjolfsson & McAfee, 2017). These studies emphasise AI's impact on financial markets rather than on entrepreneurial competencies. Earlier discussions have widely analysed AI-enabled learning tools, such as adaptive learning systems and simulation platforms. Still, comprehensive studies on AI's impact on entrepreneurial knowledge and skills remain limited. However, the existing literature has highlighted conceptual or theoretical insights, but the lack of quantitative evidence on technology-based data-driven approaches remains a limitation. In a developing country like

India, the use of AI-enabled technology in entrepreneurial education remains very limited. Particularly, rural people do not know how to use technology, resulting in a lag in the region. The digital divide includes disparities in internet access, infrastructure, and technological awareness (UNESCO, 2021). The role of AI adoption in rural areas is always underexplored. While the Technology Acceptance Model (TAM) emphasises user acceptance, it does not explain how much users use AI-related models to build their knowledge and skills.

The paper discusses a few policies, such as Startup India, Skill India, and Institutional support from organisations like NITI Aayog and the National Skill Development Corporation. However, integrated, policy-oriented research remains limited, particularly on AI-based entrepreneurial business education and aligning skills with industry requirements. The ethical and governance-related issues are insufficiently addressed in empirical research. Few studies address data privacy, algorithmic bias, transparency, and accountability, and the evidence is limited. This study focuses on trust, adoption and outcomes in AI-based entrepreneurial learning environments (OECD, 2021; Sambasivan et al., 2021). Another gap in the existing literature is that either qualitative or quantitative research integrates AI with entrepreneurship education and skills. However, this study adopts a comprehensive mixed-methods approach that combines statistical analysis with behavioural insights to capture AI's multifaceted impact on entrepreneurial business education and practice. Finally, technology-based studies have been explored in developing countries but lag in developed countries. The study provides evidence of socio-economic, cultural, and infrastructural realities to inform policymakers on how to leverage these realities to upgrade entrepreneurs' knowledge and skills for sustainable economic development. It may be concluded that the key research points have been explored in empirical validation, with insufficient focus on inclusivity and digital literacy, limited policy evaluation and the absence of context-specific frameworks for AI-driven entrepreneurial education in India. Addressing these gaps will lead to more effective, inclusive and sustainable AI-enabled learning ecosystems in emerging economies.

Research Questions: Based on the research problem and gap, the study formulates the following research questions.

1. How does AI-based learning enhance entrepreneurial outcomes?
2. How do AI tools affect startup success rates in India?
3. What is the role of digital literacy in improving entrepreneurial business education?
4. To determine the extent to which AI-enabled training platforms can improve learning outcomes for students and aspiring entrepreneurs.
5. To identify policy interventions to strengthen AI-enabled entrepreneurial education in India.

Research Objectives: The following objectives of the study include:

1. To study the impact of AI-based learning on entrepreneurial business education and skill development.
To examine how AI-based learning enhances competencies such as problem-solving, creativity, and decision-making.
2. To analyse access to AI tools and their impact on startup success rates across India.
This aims to assess how access to AI tools influences startup success rates, suggesting that greater access leads to higher success rates.
3. To evaluate the role of digital literacy in improving entrepreneurial business education.
This aims to explore how digital literacy enhances knowledge in business education, enabling entrepreneurs to understand and resolve business-related problems.
To assess the effectiveness of AI-enabled training platforms in improving learning outcomes for students and aspiring entrepreneurs.
4. AI-based learning platforms help improve entrepreneurial outcomes in the real-world, dynamic business environment.

To provide recommendations for policymakers on adopting AI, leveraging entrepreneurial business education, and enhancing skills.

5. Finally, this study recommends integrating AI into entrepreneurial education systems to enhance skill development and economic growth.

Hypothesis Development: The key hypotheses include

- H1: AI-based learning has a significant positive impact on learning outcomes.
- H2: Digital Literacy significantly influences Learning Outcomes.
- H3: Learning outcomes positively influence Startup Success.
- H4: Access to AI platforms significantly influences startup success.

These hypotheses are grounded in theoretical frameworks such as the Technology Acceptance Model and Human Capital Theory. The relationship among them is causal: technology adoption, skill development, and entrepreneurial performance.

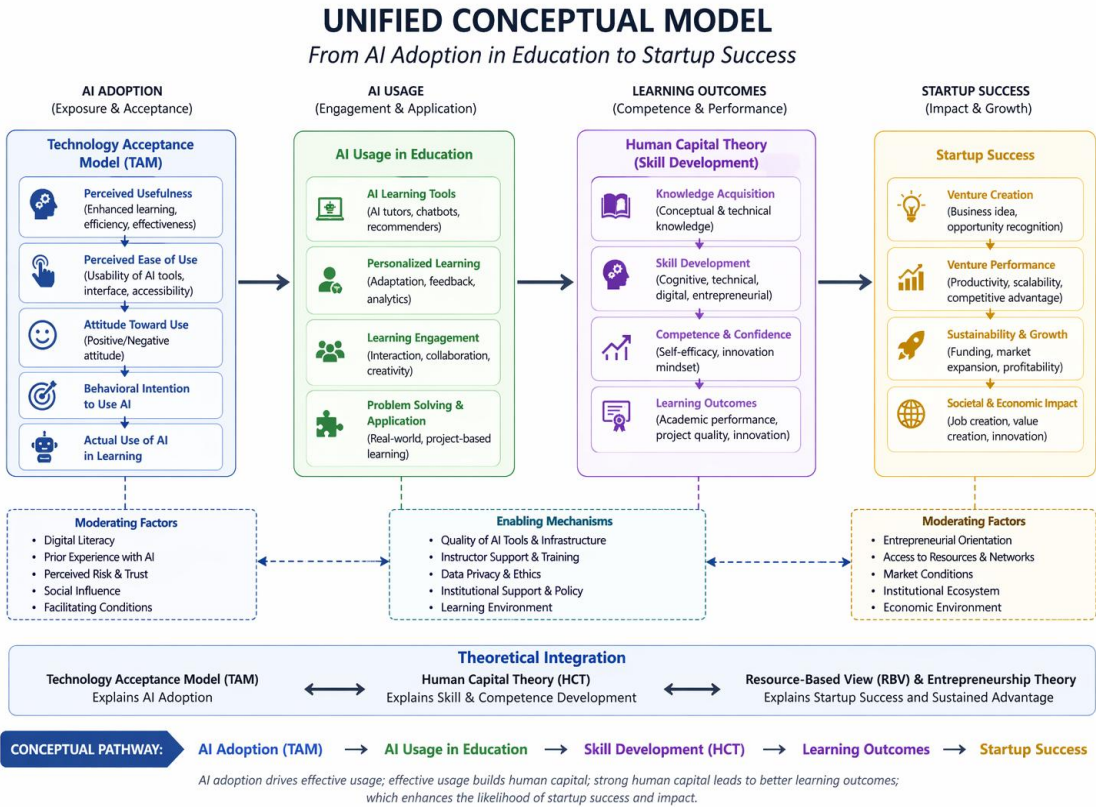
Conceptual Model: The following Unified Conceptual Model diagram shows how the Technology Acceptance Model for AI adoption influences Human Capital theories of skill development. This diagram clearly shows how AI use leads to learning outcomes and, ultimately, to startup success.

The Technology Acceptance Model (TAM): This model explains how individuals adopt AI tools based on perceived usefulness and ease of use. This model is essential for understanding AI adoption in business education.

Human Capital Theory: This model highlights the role of education and skill development in enhancing productivity and economic outcomes. AI-based learning is influencing mechanisms for enhancing human skills and knowledge.

Entrepreneurship Theory: This theory explores opportunity identification, innovation, business models, and risk-taking, all of which AI-based insights can enhance.

The conceptual model proposes that AI-based learning influences learning outcomes and impacts startup success. Digital literacy moderates this relationship, strengthening it. This conceptual framework provides a structured approach to analysing AI's impact on entrepreneurial business education.



Methodology

Research Design: This study uses a mixed-methods approach, combining quantitative and qualitative methods to examine AI's impact on entrepreneurial business education and skill development.

Quantitative Phase: Data are collected via a structured questionnaire using a Likert scale. Statistical techniques such as descriptive analysis, correlation, and regression are used to examine relationships between variables. The quantitative analysis focuses on the relationship between AI-based learning (independent variable) and the outcomes (dependent variables).

Qualitative Phase: Semi-structured interviews will identify behavioural patterns and perceptions among learners and stakeholders. This study is designed to understand both components comprehensively, providing measurable and contextual insights. This approach ensures a comprehensive understanding by combining numerical and contextual interpretations.

Explanatory Sequential Design: The study uses qualitative interviews to explain statistical results. It is based on collected and analysed data, followed by qualitative data (interviews with respondents, i.e., students and aspiring entrepreneurs). Interviews explain the numerical results. One limitation of this study is its cross-sectional design; future studies should be conducted longitudinally.

The sample and target respondents

The study uses a sample of 400 respondents, divided equally among students, aspiring entrepreneurs, educators/trainers, and related stakeholders from the institution. This equal distribution supports comparative analysis for future research and ensures representation across groups and regions. Respondents are drawn from entrepreneurial business education institutions across India. The study uses stratified sampling to ensure an equal distribution, similar to quota sampling. Future studies should refine the sampling framework to enhance generalizability. The study recognises four regions (North, East, West, and South) across India. Institutions include universities, incubation centres, and entrepreneurial ecosystems across India. For this study, the researcher used 100 MBA final-year students, 100 entrepreneurs from the list of registered startups under three years old, 100 educators and trainers from educational institutions, and 100 members of the management of institutions using advanced technologies. The sample size is calculated using Yamane's/Cochran's formula. The finite population correction formula is $n = n_0 / [1 + (n_0 - 1)/N]$. $n_0 = 1.96^2 * 0.5(1 - 0.5)/0.05^2 = 0.9604/0.0025 = 384.16$. Based on the formula and calculation, the minimum number of participants for the survey is 400.

Sl. No.	Respondents	No. of respondents	Formula Yamane's/Cochran's	Sample Size
1	MBA Final year students	100	$[1 + (n_0 - 1)/N]$ $n_0 = 1.96^2 * 0.5(1 - 0.5)/0.05^2 = 0.9604/0.0025 = 384.16$	The total sample size rounded as 400
2	Aspiring entrepreneurs (list of registered startups)	100		
3	Educators/Trainers	100		
4	Institution Management	100		

Variables and Measurement

- Independent Variables: AI-based learning, AI access, and digital literacy. These are measured by frequency of use and perceived use (questionnaire Likert scale).
- Dependent Variables: Learning outcomes and startup success rates.

The above variables are measured using structured questionnaires. Learning outcomes are measured in terms of skill development and knowledge enhancement, while startup success is measured by indicators such as business performance and sustainability. Instruments used

Instrumentation and Validity

This study employs a structured questionnaire and semi-structured interviews. Reliability is assessed using Cronbach's alpha to ensure internal consistency. Content validity is established through expert review, while construct validity is grounded in established theoretical frameworks. However, future research will report validation metrics in more detail. The structured questionnaire used a 5-point Likert scale to measure learners' perceptions and outcomes.

Semi-structured telephone interviews were conducted to obtain valuable insights.

For this study, Cronbach's alpha (> 0.70) was used to assess data reliability. Based on established scales, Davis's TAM for AI adoption, and reported validity and reliability, Cronbach's alpha exceeded 0.70 for each construct.

Procedure for data collection: An appropriate procedure followed step-by-step for collecting the data

- Based on a literature review and the study objectives, we conducted an interview and developed a questionnaire.
- To ensure clarity and reliability, a small group refined and conducted the study.
- For selecting the institutions and incubation centres based on networks
- Primary data were collected through questionnaire distribution (online/offline) and telephonic interviews.
- Secondary data were collected by reviewing government reports, academic journals, and World Bank, NSDC, and NITI Aayog reports.
- The validity of data before analysis involved cleaning and coding.

Formal Ethics Statement: Before surveying with respondents (students, aspiring entrepreneurs, trainers, and institutional management), the researcher obtained Institutional Review Board (IRB) approval to survey 400 respondents and obtained respondents' consent regarding "data privacy and ethical considerations". For this context, the sequence of approvals includes (i) Approval by the Institutional Review Board, (ii) Consent from the respondents, (iii) Conducting a formal survey and collecting responses- quantitative analysis, and (iv) Interviews with the respondents regarding qualitative analysis.

The timeline for completing the task is about 5 months. For instrument development, 2 weeks; data collection, 8 weeks; data analysis, 4 weeks; and preparation of the report, 4 weeks.

Data Analysis: The data analysis includes:

Descriptive Statistics: This study used Mean and Standard deviation (AI-based learning, Digital Literacy, Access to AI tools and Learning Outcomes).

Correlation Analysis: Relationship between variables (AI-based learning, Digital Literacy, Access to AI tools, Learning Outcomes, Startup success).

Regression Analysis: Impact of independent variables on outcomes.

- Quantitative Analysis: This includes descriptive statistics (Mean, Standard Deviation) and inferential statistics, such as correlation and regression analysis.
- Qualitative Analysis: Here, these components are used to identify patterns in behavioural data and perceptions.
- For this study, SPSS was used, and hypotheses were tested using significance values; the p-value was less than 0.05.

The analysis showed a strong positive correlation among AI learning, Digital literacy, Learning outcomes, and startup success. The cross-sectional design limits causal interpretations.

Ethical considerations include clearly informing participants before the survey about the study's purpose, scope, and voluntary nature. Their opinions are kept confidential, and this data is used for academic purposes. This data was stored and accessible only for research purposes. This study ensured no harm, bias, or discomfort for participants.

The study focuses on the impact of AI on entrepreneurial business education and skills. It uses a mixed-methods approach, combining both quantitative and qualitative analyses to understand the research problem. Data are analysed using descriptive statistics, including variables such as AI-based learning, learning outcomes, startup success rates, and digital literacy. Data are collected from both primary and secondary sources. Primary data are collected through questionnaires and telephone interviews. The target respondents include students, aspiring entrepreneurs, trainers, and related organisations. The total sample size is 400, with 100 respondents from each group. Secondary data are drawn from government reports, academic journals, scholarly publications, and policy documents from NITI Aayog and the World Bank. This study uses stratified sampling to collect data from different regions, incubation centres, universities, and aspiring entrepreneurs across India. Statistical tools include descriptive statistics (mean, standard deviation), correlation, and regression analysis to analyse the data and support informed decision-making. For qualitative data, the study conducts learner behavioural studies and uses thematic analysis to identify patterns. This methodology aims to provide policymakers with the insights needed to develop strategies that align AI with entrepreneurial education and skills, thereby enhancing educational practices and skill development in India.

Results and Interpretations: Descriptive statistics indicate high AI-based learning usage (mean 4.12) and high literacy. AI tools' accessibility among respondents is moderate, with scope for improvement. Finally, learning outcomes show significant improvement (mean = 4.20). Most respondents are aware of advanced technology. Based on the operational definition of the variable and the established scales, Davis's TAM for AI adoption learning usage is 4.12 (mean value of Qn. 10-15 and Qn. 16-21).

Table 1: Descriptive Analysis

Variable	Mean	Std. Deviation	Interpretation
AI-based Learning Usage	4.12	0.68	High adoption among respondents
Digital Literacy	3.95	0.74	Moderate to high competency
AI Tools Accessibility	3.78	0.81	Moderate access with scope for improvement
Learning Outcomes	4.20	0.65	Significant improvement observed

The study's results indicated that AI-based learning significantly improves learning outcomes, but access and literacy still influence the extent of those benefits.

Correlation Analysis: the relationship between two values. The implications include (+, -, and 0). A positive correlation indicates a relationship between the values; a negative correlation indicates a negative relationship; and zero indicates no relationship between the values.

Variables	1	2	3	4
AI Learning	1			
Digital Literacy	0.62	1		
Access to AI Tools	0.58	0.66	1	
Learning Outcomes	0.71	0.69	0.64	1
Startup Success	0.65	0.61	0.59	0.73

Interpretation: There is a strong correlation between learning outcomes and startup success (0.73). The second is the high correlation between learning outcomes and AI Learning. The remaining variables were 58 between 0.70 and 0.70. There is a strong correlation among all variables, but the strongest are Startup success and Learning Outcomes, and Learning Outcomes to the AI Learning approach.

Regression Analysis: These analyses demonstrated the relationship between independent and dependent variables. It clearly shows that the impact of the independent variables, including AI Learning, Digital Literacy, Learning Outcomes, and AI Access, on the dependent variables is statistically significant ($p < 0.05$).

The Variance Inflation Factor (VIF) measures the variance of an estimated regression coefficient. A VIF of 1 indicates no multicollinearity, while VIFs $>5-10$ suggest severe multicollinearity requiring action. To calculate the Coefficient of determination, the study requires your regression output. It represents the proportion of the dependent variable (e.g., startup success) explained by the independent variables (AI Access, AI learning, and digital literacy).

- R^2 values are the ratio between Regression Sum of Squares (SSR) and Total Sum of Squares (SST). $R^2 = 284.14/412.58$. Finally, the R^2 value is 68.86%. Hence, 68.9% of the variation in Startup Success is explained by three Independent variables. This indicates a strong and substantial effect on startup success.
- The adjusted R^2 value is a more accurate measure as it penalises the addition of unnecessary variables. Adjusted $R^2 = 1 - ((1 - R^2)(n - 1) / (n - k - 1))$. Adjusted $R^2 = 0.686$. The variables are genuinely contributing to the model's predictive power without "overfitting."

Dependent Variable	Independent Variable	Beta	t-value	Significance
Learning Outcomes	AI Learning	0.48	8.21	$p < 0.01$
Learning Outcomes	Digital Literacy	0.32	5.67	$p < 0.01$
Startup Success	Learning Outcomes	0.52	9.10	$p < 0.01$
Startup Success	AI Access	0.29	4.89	$p < 0.01$

$R^2 = 68.86\%$; Adjusted $R^2 = 68.6\%$

Interpretation: AI-based learning has a significant positive effect on learning outcomes, which in turn strongly influences startup success. Digital literacy also plays a crucial supporting role. Discussion: Overall, the study's findings indicate strong relationships among the variables, including AI-based learning, digital literacy, access to AI, learning outcomes, and startup success. Across all variables, the relationships are positive. In particular, the Beta values for AI Access to Startup Success and Digital Literacy to Learning Outcomes were 0.29 and 0.36, respectively. This may reflect respondents' greater interest in learning through digital means than in accessing the tools. The study confirms that AI-enabled education fosters entrepreneurial learning by making it more personalised, data-driven and experiential. The study aligns with existing literature while providing empirical evidence. This may explain why respondents showed self-bias in this study. A future study will explore why respondents are not interested in AI access tools. In this context, the significant relationships between the independent and dependent variables are shown: AI-based learning, digital literacy, and access to AI are independent variables, and learning outcomes and startup success are dependent variables. The significance level is <0.01 .

The study's overall findings reveal that AI-based learning improves learning outcomes. Digital literacy enhances the effectiveness of AI tools, while improved learning outcomes contribute to startup success.

Hypotheses Testing

H1: AI-based learning has a significant positive impact on learning outcomes. The Beta value is 0.48, the t-value is 8.21, and the p-value is less than 0.01. The analysis clearly indicates that AI-based learning has a significant impact on learning outcomes.

H2: Digital literacy significantly influences learning outcomes. Digital literacy is the independent variable, and it significantly influences AI adoption and learning outcomes. The Beta value is 0.32, and the t-value is 5.67. The p-value is less than 0.01.

H3: Learning outcomes to Startup Success. The Beta is 0.52, and the t-value is 9.10. Hence, improving outcomes and learning positively impact a startup's success. The p-value is less than 0.01.

H4: AI Access to Startup Success Rates. The impact of access to AI tools on startup success. It has a positive impact; the p-value is less than 0.01.

Hypotheses Testing Summary

Hypothesis	Relationship	Result	Remarks
H1	AI Learning to Learning outcomes	Supported	Strong positive effect
H2	Digital literacy to Learning outcomes	Supported	Moderate positive effect
H3	Learning outcomes to startup success	Supported	Enhances effectiveness
H4	AI Platforms to Startup success rates	Supported	Significant improvement

Interpretation: All hypotheses are supported, confirming that AI plays a critical role in entrepreneurial business education and success, with digital literacy acting as an important moderating factor.

The conceptual model of the study is structured as follows:

Independent Variables,	Moderating Variable,	Dependent Variable
AI-based Learning	Digital Literacy	Startup Success
AI Tools Accessibility	Learning Outcomes	

AI-based business education of entrepreneurs through AI's influence on economic growth: AI-based education as a transformative approach, benefiting both micro and macro levels. AI-based business education enhances skills, improves decision-making, and fosters innovation; at the macro level, it improves productivity, generates employment, and drives overall economic growth. It is the conceptual link between AI, Entrepreneurship, and economic growth. It influences skill development, innovation and creativity for entrepreneurs, as well as market intelligence and operational efficiency. The model suggests that higher startup success rates lead to higher productivity, which in turn creates jobs and ultimately increases economic growth.

AI-driven entrepreneurial business education and economic indicators

Indicator	Traditional Education	AI-Enhanced Education	Economic Impact
Startup Success Rate (%)	40–50	65–80	Increased business survival
Productivity Growth (%)	2–4	6–10	Higher output efficiency
Innovation Index Score	Moderate	High	Boost in R&D and patents
Indicator	Traditional Education	AI-Enhanced Education	Economic Impact
Startup Success Rate (%)	40–50	65–80	Increased business survival
Employment Generation (%)	3–5	8–12	More job opportunities
Revenue Growth of Startups (%)	5–10	15–25	

Based on the table above, AI-based business education has significantly outperformed traditional methods. At the same time, startup rates increase because of better planning, predictive analytics, and market insights. As a result, productivity and revenue also rise because entrepreneurs can optimise operations through AI. Finally, it supports stability and expansion.

Role of AI-based education and skills in economic development.

AI-Based Skill	Entrepreneurial Benefit	Economic Outcome
Data Analytics	Better decision-making	Efficient resource allocation
ML	Demand prediction	Reduced market risks
Automation Skills	Cost reduction	Increased profitability
Digital Marketing with AI	Customer targeting	Higher sales volume
Financial Forecasting (AI)	Risk management	Sustainable growth

From the above table, it is clear that AI-based education and skills also lead to entrepreneurial benefits and economic outcomes. AI-based data analytics benefits entrepreneurs' decision-making and enables efficient resource allocation. ML skills provide demand prediction and reduce market risk. Automation skills reduce costs and increase profitability. AI-enabled digital marketing enables customer targeting and higher sales volume, and financial forecasting supports risk management and sustainable economic growth.

AI-based skills empower entrepreneurs to take informed strategic decisions. For example, data analytics and ML help understand consumer behaviour, predict demand, and reduce future uncertainty. While automation reduces operational costs, it also influences profit and directly contributes to economic growth. AI-based skills empower entrepreneurs to make informed, strategic decisions—for instance, data analytics and ML help them understand consumer behaviour and predict demand, reducing uncertainty. Automation reduces operational costs, thereby improving profit margins and directly contributing to economic growth.

The sector-wise impact of AI-driven decisions on Entrepreneurship

Sector	AI Application	Impact on Growth (%)	Key Outcome
Manufacturing	Predictive maintenance	10–15	Increased efficiency
Healthcare	AI diagnostics & telemedicine	12–18	Improved service delivery
Agriculture	Smart farming	8–14	Higher crop yield
Retail/E-commerce	Recommendation systems	15–25	Increased sales
Finance	AI-based risk assessment	10–20	Increasing benefit

The table above clearly indicates that sector-wise use of AI applications increases growth percentages and key outcomes. The first manufacturing sector to adopt AI applications for predictive maintenance achieved a 10-15% growth rate, and AI increased efficiency in this sector. The second sector is health, using AI applications such as AI diagnostics and telemedicine, which has led to a 12-18% growth in that sector and improved service delivery outcomes. The agricultural sector uses AI applications for smart farming, improving growth by 8-14% and increasing crop yields. Another sector is retail/e-commerce, which uses AI applications for recommendation systems and sees a 15-25% increase in sales. The final sector is finance, which uses AI applications for risk assessment, with a 10-20% growth rate and increased benefits.

The relation between AI adoption level and economic growth

AI Adoption Level	Entrepreneurial Activity	GDP Growth Rate (%)	Economic Status
Low	Limited	2–3	Developing
Medium	Moderate	4–6	Emerging
High	Advanced	7–10	Developed/Innovative

AI adoption is positively associated with indicators of business growth and economic performance. The above analysis, correlation, and regression establish relationships but do not confirm causality. Therefore, it is not clear whether AI adoption directly leads to economic

status, such as a developed economy or improved economic status. Additionally, AI may help improve decision-making skills, but external factors also influence economic performance. Hence, future longitudinal research is needed to establish a causal relationship between AI adoption and economic growth.

The Mechanisms between AI adoption and economic growth:

- (i) Increased productivity: When AI is adopted in any sector, it automatically optimises business processes, enabling entrepreneurs to focus on innovative products, services, and processes, as well as on implementing innovative strategies for sustainable development.
- (ii) When entrepreneurs adopt AI that generates new model results, it drives the development of new products, services, and processes, thereby supporting economic diversification.
- (iii) Adopting AI creates new products and opportunities. As a result, it creates new jobs for unemployed people. This supports economic development.
- (iv) Global Competitiveness: Entrepreneurs trained in AI can compete in global markets by improving productivity, meeting global competition, and increasing foreign exchange earnings.
- (v) Financial inclusion: AI-based FinTech solutions improve access to credit and financial services. As a result, it reduces borrowing and transaction costs and especially supports small and medium-sized firms.

Despite many advantages, challenges include limited AI infrastructure, the digital divide, high implementation costs, and ethical and regulatory concerns. To maximise these benefits, policymakers and educational institutions should integrate AI into curricula, promote skills development programmes, and ensure inclusive development. Overall, AI adoption in education and in entrepreneurs' skill development is shaping the future of entrepreneurship and the global economy.

The Findings of the Study

The study analysed key findings on the effectiveness of AI-enabled technology for entrepreneurial education and skill development. The major finding is that AI technology can support entrepreneurial education and skill development, including critical and deep thinking about real-time problems, making data-driven decisions, and identifying opportunities to develop business models that can be sustained in a dynamic future. To support learners, organisations such as the National Skill Development Corporation and NITI Aayog offer courses to upgrade their skills. This supports the transformation from theoretical knowledge to practical orientation. AI tools available to learners help improve learning outcomes. These tools enable analysis of market trends and customer behaviour, and predict financial requirements to meet short- and long-term needs. Moreover, they reduce uncertainty and improve operational efficiency. A key finding is that AI-based learning has a statistically significant positive impact on the development of entrepreneurial knowledge and skills. The p-value is less than 0.01, indicating that AI tools are being used to enhance entrepreneurial knowledge and skill development. Digital literacy is also required for learners, but it is not a prerequisite for students. Effective implementation of AI tools and techniques requires digital literacy. To support digital literacy, makers need infrastructure, institutional support, staff availability, and policy framing. In rural areas, this is a major constraint. With digital literacy, entrepreneurs can make effective decisions. The study proved that digital literacy significantly moderates AI adoption and improves learning outcomes. The significance value is less than 0.01.

Another significant finding is that the government has provided training facilities to aspiring entrepreneurs. Government organisations, including the National Skill Development Corporation (NSDC) and the National Institution for Transforming India (NITI) Aayog, play a crucial role in promoting skill development among students. Both organisations provide

training and support through incubation centres and funding agencies to encourage budding entrepreneurs. The study finds that AI-enabled training platforms improve learning outcomes for entrepreneurs. Using AI tools positively impacts a startup's success. The p-value is less than 0.01. Another important finding is that learning outcomes significantly influence startup success. An entrepreneur who does not adopt AI-enabled tools can still experiment with new ideas, test business models, and identify trends. As a result, the learning outcomes lead to the development of new products and services, sustainable startups, and, finally, a knowledge-driven economy. The study found that learning outcomes significantly influence startup success. It has a significant impact on the startup's success, with a p-value of less than 0.01. Despite many advantages, the study also found several challenges related to AI integration. In rural areas, the digital divide, unequal access to technology, privacy and security concerns, and weak government policy and institutional support remain major barriers.

Theoretical Contributions and Practical Implications

The study makes several important contributions to the literature on AI and entrepreneurial business education by expanding knowledge and skills.

1. **Integration of AI-enabled entrepreneurial learning theory:** The study aimed to extend traditional entrepreneurship theories by incorporating an AI-based learning approach. It is not only a technology tool. It shifts toward an experiential, real-world, data-driven decision-making learning approach.
2. **Enhancement of a Multi-Variable Conceptual Model:** The study proposes a comprehensive conceptual framework based on the analysis. These include AI-enabled entrepreneurial business education, AI tools accessibility (independent variable), digital literacy (moderating variable), learning outcomes and startup success (dependent variable). This study indicates how multiple dimensions interact simultaneously.
3. **The role of digital literacy as a moderator between AI and Startup Success Theory:** Digital literacy moderates the relationship among AI-based tools, learning outcomes, and startup success. AI tool adoption alone is insufficient. Hence, digital literacy interventions enhance learning outcomes and startup success.
4. **The study provides empirical evidence for the AI-Entrepreneurship Theory:** it demonstrates the link between AI and Learning Outcomes and shows how Learning Outcomes influence startup success. Still, this theoretical linkage between technology-enabled business education and entrepreneurial performance was absent from academic research.
5. **Extension to Economic Development Theory:** This study contributes to macroeconomic theory, as AI-enabled entrepreneurial business education is a key driver of productivity, employment, innovation, and economic growth.
6. **Reinforcement of Human Capital Theory:** The study suggests that AI-enhanced skills increase individual and economic productivity.

The Practical Implications: Based on its findings, the study provides insights for entrepreneurs and institutions. These are including

- 1) **Educational Institutions: Integration of AI tools into curricula:** Enhancing the knowledge and skills of entrepreneurs who need to integrate AI tools into entrepreneurial course curricula, shifting from a theoretical, experiential and practical approach to developing AI labs, simulation tools and data analytics modules, and improving the learning outcomes of learners in business education to enhance knowledge of entrepreneurial success.
- 2) **Government bodies and Policymakers' investment in digital Infrastructure:** For government bodies and policymakers, AI-based entrepreneurial business education can improve learning outcomes and startup success. To this end, policymakers need to invest in digital infrastructure, promote AI literacy programmes, and strengthen

government institutions, including NSDC and NITI Aayog. Additionally, they should facilitate subsidies, fund AI-based startups, and support incubation centres.

- 3) **Adoption of AI for decision-making by Entrepreneurs:** AI-enabled business education clearly influences startup success. Entrepreneurs and startups should adopt AI tools for market analysis, demand prediction, and financial forecasting, as these tools have the greatest impact on success. The beta value has already been shown to be 0.52. AI tools are influencing digital literacy and entrepreneurs' success.
- 4) **Training Organisations: Development of AI-based skill programs:** Adopt AI tools, including ML applications, data analytics tools, and automation technologies, to enable practical problem-solving and real-time decision-making.
- 5) **Collaboration with academic institutions:** Educational institutions should collaborate with academic institutions through hands-on experiences, such as industry-related curricula, to secure internships in AI-driven environments, thereby increasing productivity and enhancing skills, including greater innovation capacity.
- 6) **Inclusive development:** To enhance the knowledge and skills of entrepreneurial business education, address challenges such as the digital divide, limited AI access and infrastructure gaps, and promote inclusive AI adoption, such as equal learning opportunities and balanced regional economic growth.
- 7) **Strategic Decision:** Based on the study, AI-enabled tools are driving improved learning outcomes, higher startup success, and economic growth. This provided a roadmap for related stakeholders to make informed decisions to enhance learners' knowledge and skills.

The Recommendations of the Study: The Key recommendations include:

Expanding digital infrastructure in rural Areas: The study's recommendations include addressing major infrastructure challenges and improving network connectivity. To this end, the government will expand network coverage in underserved areas. This will require policy implementation to maximise rural potential.

Promoting digital platforms and AI literacy programs: The digital divide refers to the lack of digital platforms in rural areas. To address this, the study recommends subsidised or free access to digital devices and AI tools, targeted training programmes for underserved communities, and multiple platforms to cater to diverse populations. The literature review identified limited awareness as a key challenge. Therefore, it is essential to run awareness campaigns to support entrepreneurs, organise seminars, conferences, and training programmes, and promote knowledge-sharing platforms among educators and entrepreneurs. Along the same lines, the government will take the initiative to raise awareness of the importance of digital literacy, and include related literacy content in school and higher education curricula. At the higher education level, compulsory certificate MOOC courses should be made available to upgrade aspiring entrepreneurs' knowledge and skills.

Supporting startups through funding and incubation centres: NSDC and NITI Aayog play a vital role. Hence, these organisations should extend their activities by collaborating with incubator centres and funding agencies to provide economic, financial, and technical support. Otherwise, entrepreneurs will not come forward to turn their concepts and ideas into reality.

Integrating AI into educational policies: The effective implementation of an AI-enabled, technology-driven platform to upgrade knowledge and skills for policy formulation and the strategic integration of AI technology. Policymakers should develop national strategies for AI in education and entrepreneurship, integrate AI with Digital India, Skill India, and Startup India, and continuously monitor and evaluate the impact of AI-based interventions.

Conclusion: Overall, AI-enabled tools and techniques are improving education and enhancing entrepreneurs' skills. In the last decade, the digital era has been characterised by its seamless influence on entrepreneurial development. It is a key enabler of individuals' ability

to adopt and use AI technologies effectively. Learners with higher digital competence are more likely to use AI for business purposes, achieving better outcomes. Currently, AI has shifted from a traditional to a learning-centric model. Using AI-enabled techniques, entrepreneurs can manage a dynamic business environment with enhanced competencies. Traditional methods are conventional and static, mostly theoretical, whereas AI-enabled platforms offer adaptive, personalised, and experiential learning. These skills are essential in today's dynamic environment, including problem-solving, creativity, decision-making, and opportunity recognition. This transformation significantly advances individuals' preparation for real-world business challenges. The study further concludes that institutions such as NSDC and NITI Aayog play a vital role in promoting and adopting AI in entrepreneurial education. These institutions create platforms for training, incubation and mentorship, enabling aspiring entrepreneurs to access AI tools and resources. This collaborative ecosystem among government, educational institutions, and industry aims to improve entrepreneurs' education and skills. Finally, AI-enabled entrepreneurial business education represents a paradigm shift from traditional learning to a dynamic, technology-driven approach by enhancing knowledge, skills, and decision-making, fostering innovation, and applying various business models to generate economic revenue. AI contributes to both individual success and economic development. AI-enabled tools and techniques used in entrepreneurial business education and skills are bridging the gap between theory and practice. This personalised, experiential learning approach enhances learners' confidence and preparedness for the dynamics of business.

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