

# Designing a University-Level Adult Pedagogy Framework to Cultivate Entrepreneurship Competencies in the Age of Artificial Intelligence

Muhammad Asim Attique<sup>1</sup>, Dr. Rukhsana Sardar<sup>2</sup>, Fakhar-Ul-Zaman<sup>3</sup>, Zainab Iftikhar<sup>4</sup>

## Abstract

*The study aims to design a university-level adult pedagogy framework for entrepreneurship competence development in the age of AI. Due to the growing complexity of developing competent learners for dynamic digital economies, it is not surprising that entrepreneurship education for adults is becoming increasingly relevant. It is further suggested that traditional pedagogy is not able to integrate practical skill development, independent learning and technology application together. This study investigates the development of a framework that harnesses artificial intelligence and autonomous learning to improve adult learners' entrepreneurial knowledge, creativity, decision-making, and self-efficacy. The researcher employed qualitative research methods by using semi-structured interviews with 15 faculty members of the Education, Psychology, English, Urdu, and Mass Communication Departments at the University of Narowal. The data was analyzed through manual thematic analysis to identify key themes and sub-themes highlighting the effect of the framework on entrepreneurship competencies. The results of the study reveal that the framework proposed in this research could enhance learners' practical skills in business planning and market analysis, stimulate creativity and innovation through experimentation and problem-solving, and improve self-efficacy and strategic decision-making. AI-powered simulations and digital applications will allow more personalized and adaptive learning experiences, while the autonomous learning preference is related to greater reflection, experimentation and applying skills independently. This study enhances the understanding of the inclusion of adult learning theory and experiential learning and social cognitive theory into higher education pedagogy. Essentially, it provides a framework for institutions to decide on ways of ensuring the competency of university members through AI-enhanced learner-centered strategies. According to the study, AI could connect theories to application-based learning, thereby providing a framework for competency-based adult learning in the digital age.*

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<sup>1</sup> Assistant Professor of Education, Deputy Director of Colleges, Narowal, Email: asimattique75@gmail.com

<sup>2</sup> Lecturer, Department of Education, University of Narowal, Punjab, Pakistan, Email: rukhsana.sardar@uon.edu.pk

<sup>3</sup> Fakhar-Ul-Zaman, Visiting Lecturer, Department of Education, University of Narowal, Punjab, Pakistan, Email: malikfakhar717@gmail.com

<sup>4</sup> Visiting Lecturer, Department of Education, University of Narowal, Punjab, Pakistan. Email: malikfakhar717@gmail.com

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## **Introduction**

Artificial intelligence (AI) has taken the world by storm, changing the way people work, create value and innovate. Artificial Intelligence is no longer reserved for labs and top firms. It plays a key role in education, business decision-making, market analysis, product design, and entrepreneurial practice (Mahmud et al., 2024). Tools that use Artificial Intelligence (AI) can support fast prototyping, allow for automated rote task performance, as well as real-time insights to boost creativity and problem solving (Zawacki Richter et al., 2019). In the higher education setting, these capabilities open up new possibilities for designing learning experiences that are more responsive, personalized, and relevant to real-world issues. However, the use of artificial intelligence in teaching is still limited. In the area of entrepreneurship education, this gap is especially evident. Universities have long offered business planning, venture creation, and small business management courses. The courses are generally reliant on lectures, fixed case studies and instructor-led discussions (Rae, 2017). Although these methods equip students with fundamental knowledge, they are weak on developing competencies such as opportunity recognition, digital literacy, adaptive thinking, and data-informed decision-making. The ability to adapt and succeed in entrepreneurial landscapes that involve uncertainty and the fast growth of technology (Neck et al., 2014).

The potential of AI refers to how it can change entrepreneurship education by supplying tools that enhance critical thinking, simulate a business environment and support iterative learning. AI scenario modeling enables those learning how to run a business to test business hypotheses. Most interestingly, learners can make use of natural language processing tools to assist in drafting business plans and or interpreting market data. At present, there isn't a coherent pedagogical framework outlining how to use AI through deliberate design in teaching entrepreneurship to adult learners. A dedicated framework would provide a guideline on the alignment of AI-enabled practices with learning outcomes and entrepreneurship.

### **1.1 Problem of the Statement**

In the age of AI, universities and colleges are grappling to make their entrepreneurship education relevant. The existing curriculum emphasizes theoretical content and traditional teaching methods, which do not reflect the technology-enhanced and dynamic nature of practice nowadays. Students taught through traditional pedagogy often have less ability to apply knowledge in complicated, real-world situations, as the research found (Neck et al.2014). Adult learners bring a wealth of experience to the learning environment and require teaching pedagogies that engage them and allow them to see the relevance to real-world outcomes (Knowles, Holton & Swanson, 2015). Teachers cannot rely on a clear AI-integrated pedagogy framework to design instruction that develops critical entrepreneurial competencies such as identifying opportunities, experimenting with business models, solving

complex problems adaptively, and using technologies strategically. The disparity hampers the capacity of tertiary education to prepare graduates for success in AI-powered economic environments.

## **1.2 Research Objectives**

1. To develop a comprehensive adult pedagogy framework that integrates AI-enabled instructional strategies for cultivating entrepreneurship competencies at the university level.
2. To evaluate how AI-integrated pedagogical components influence adult learners' development of core entrepreneurial competencies, including opportunity recognition, creative problem solving, and business planning.

## **1.3 Research Questions**

1. What are the key components of an AI-integrated adult pedagogy framework that effectively cultivates entrepreneurship competencies in university learners?
2. How does the application of this framework influence the development of core entrepreneurship competencies among adult students?

## **1.4 Rationale of the Study**

This research is significant since current entrepreneurship education does not have a strategic model for embedding AI in a way that enhances meaningful competency development. Universities tend to adopt technology tools in batches, but do not link them to any learning outcome or principles of adult learning. Adult learners need a pedagogical design that respects their experience, is relevant to real life and facilitates participation. This research will fill a gap in theorizing and practicing an entrepreneurship framework that explicitly maps AI tools and strategies to entrepreneurial competencies. The framework developed will assist the educators to align the learning activities with desired competencies and use AI to improve skills. Curriculum developers will also be guided by it to create courses that prepare learners to meet modern entrepreneurial challenges.

## **1.5 Significance of the Study**

The study benefits several fields. To begin with, it enhances the academic study in entrepreneurship education by showing a systematic approach on how to introduce AI into education. This framework can help a university modernize the curriculum as per the requirements of the digital economy. Second, it helps adults learn by applying principles that make use of their prior knowledge. The structure gives practical design principles that inform educators in creating meaningful learning experiences. Third, it informs policymakers and institutional leaders on investment in technology and training, which enhances employability and innovation skills. Ultimately, the research study confirms the development of a graduate who can use AI to identify opportunities, make informed decisions and innovate ethically in their own ventures.

## **1.6 Limitations of the Study**

There are multiple limitations to the study. The scope of the study is on adult learners in selected university entrepreneurship programs and does not generalize to other learner groups or education levels. This framework is based on theory with the input from literature and experts, although this can be empirically tested through wider use in different educational contexts. The rapid advances in AI technology are allowing components of the framework to become outdated, requiring continuous modification. The scope of future research may include longitudinal student outcomes and cross-institutional comparisons.

## **2. Literature Review**

The growing importance of technology in learning and skills development has resulted in a dramatic increase in the research on higher education pedagogy, entrepreneurship education and artificial intelligence (AI). The application of artificial intelligence in education to personalize learning, offer real-time feedback and help problem-solving (Zawacki Richter et al., 2019) is on the rise. In a similar way, entrepreneurship education makes use of experiential and practice-based learning approaches that allow students to develop competencies in opportunity recognition, creativity, business planning, and others (Neck et al., 2014). There are limited studies regarding the systematic adoption of AI in adult pedagogy to hone entrepreneurship competencies. This literature review evaluates the existing research, identifies limitations, and contextualizes the proposed research as part of a wider discourse on the subject.

### **2.1 The Intersection of AI and Higher Education Pedagogy**

According to Holmes et al. (2021), AI in higher education is widely sought after to enhance learning outcomes through intelligent tutoring systems, adaptive assessments, and automated feedback mechanisms. With the utilization of these tools, personalized learning paths can be confirmed that will adjust real-time instructional content along with student engagement, backed up with data. Although these studies show how AI has the potential to enhance student performance, a majority of them only focus on technical abilities and insufficiently on the pedagogical frameworks that facilitate effective learning. The application of AI in adult learning is not well researched. Adult learners engage in self-directed and experiential learning, which is relevant to their day-to-day life situations. Nevertheless, the AI literature in higher education has deviated from this gist. Therefore, there is a need for a framework that integrates technology with adult-centered pedagogy (Knowles et al., 2015).

### **2.2 Entrepreneurship Education in Higher Education**

According to Rae (2017), entrepreneurship education emphasizes the development of practical skills and competencies through experiential learning, action-oriented projects, and reflective practice. The traditional methods of teaching entrepreneurship often fail to build the complexity of skills required in a real-world scenario. Traditional teaching methods, lectures, and case studies only give students

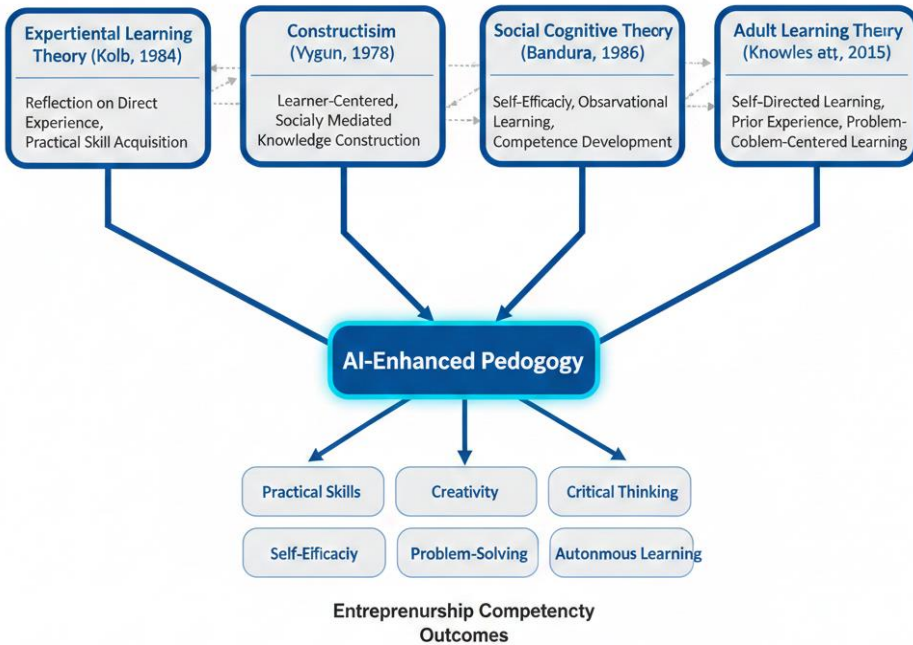
knowledge, which fails to teach skills required in the real-world entrepreneurial environment (Vanevenhoven & Liguori, 2013). Experiential methods, notably simulations, venture creation projects, and business plan development, are better suited to apply theory in practice. However, these methods often fall short in terms of technology and do not employ AI tools to help improve the learning experience. As a result, graduates may be poorly placed to deal with dynamic, technology-infused firms, indicating a need for pedagogical innovations integrating AI in entrepreneurship education.

### **2.3 AI in Entrepreneurship Education**

In recent years, research aimed at the entrepreneurial learning context has explored how entrepreneurs can use AI software. AI can assist in creativity, opportunity recognition, testing business models and decisions based on data (Park et al., 2025). Business students can use predictive analytics to simulate markets and natural language processing tools to write a business plan or generate a novel idea. Research often thinks about AI as a tool rather than embedding it into a pedagogical framework, although these are promising. The absence of structured frameworks that incorporate the capabilities of digital technology with practices of adult learning and entrepreneurial competencies means that their practical use in higher education is ineffective. The gap in knowledge has been addressed in this study by designing a framework that allows the incorporation of AI tools into the teaching and learning process to improve entrepreneurship competencies.

### **2.4 Theoretical Foundations in the Literature**

Entrepreneurship education should include experiential learning, constructivism and social cognitive principles. According to Kolb's (1984) experiential learning theory, learning comes from reflection on direct experience, which supports the acquisition of practical skills. According to Vygotsky (1978), learners are centered and social approaches. The theory highlights that the development of human competence is highly dependent on self-efficacy and observational learning. Andragogy focuses on self-directed learning experiences, previous experiences, and problem-centered approaches that pertain to adults (Knowles et al., 2015). The current study embraces a multi-theoretical approach that blends these theories to guarantee that AI-enhanced teaching fits the cognitive, experiential and motivational needs of adult learners. Alternative approaches, such as behaviorist or technology-centered models, seemed less suitable as they do not account for the socio-cognitive processes involved in entrepreneurial learning.

**Figure 1: Theoretical Framework**

The AI-Enhanced Entrepreneurship Education's formal theoretical framework for adult learners is a multidimensional construct that integrates four pillars of theory. These four pillars were already built to suit the cognitive and motivational needs of the adults. A framework that was developed by combining these theories will postulate that Artificial Intelligence (AI) should not merely be an instrument to be used in the development of entrepreneurial competencies, but should also be a pedagogy.

### Psychological and Andragogical Integration

The framework is also underpinned by Social Cognitive Theory (SCT) (Bandura, 1986) and Adult Learning Theory/Andragogy (Knowles et al., 2015), which looks at internal drivers of success. The Social Cognitive Theory element promotes the acquisition of self-efficacy and observational learning. AI by enhancing SCT, makes various entrepreneurial scenarios visible for modeling and provides real-time data-driven feedback, allowing learners to interact successfully with AI-enhanced tasks multiple times for confidence building. Andragogy: Adult learners tend to be self-directed and need problem-centered learning. This system, leveraging the power of AI, delivers self-directed learning journeys that take into account of the students' past experiences and enable them to forgo what they already know and cherry-pick what they need to supplement their entrepreneurial toolkit.

## AI as the Pedagogical Nexus

The AI-Enhanced Pedagogy lies at the center of the framework and connects the inputs and outputs of theory. This core node turns the theoretical principles of the four core concepts into a coherent teaching strategy. This AI-integrated method takes into account the socio-cognitive specificities of the entrepreneurial mindset, unlike traditional behaviorism models, which rely on rote learning or sequential development.

## Competency Outcomes

The combination of these theories through AI-driven instruction results in the development of specific entrepreneurship competencies. These include:

- **Practical Skills & Creativity:** Having emerged from experiential and constructivist origins.
- **Critical Thinking & Problem-Solving:** AI interaction enhances interaction with an analytical nature.
- **Self-Efficacy & Autonomous Learning:** Underpinned by Bandura's and Knowles' concepts of agency and self-direction.

This framework deliberately adopts a non-techno-centric and non-behaviorist stance. Models of entrepreneurship that do not promote critical thinking are regarded as inadequate for adult entrepreneurship education. It is because they do not include socio-cognitive processes like social negotiation of meaning and self-reflective practice. Further, these socio-cognitive processes are key to achieving twenty-first-century success.

## 1.5 Gaps in the Existing Literature

Although there is research on the application of AI in education and entrepreneurship, the gaps are quite significant. AI research focuses more on tool capabilities than on incorporating tools into structured didactics. Secondly, most entrepreneurial education does not systematically include AI and is very traditional and experiential in nature. Third, the principles of adult learning are underrepresented in studies that combine technology and entrepreneurship education. Finally, there are few studies that create overarching models that connect AI applications to competencies and teaching objectives. The existence of these gaps points to the necessity of research that is capable of providing a structured, underpinned framework of AI-enhanced adult pedagogy with a specific focus on entrepreneurship competencies.

According to the literature, AI has the potential to transform education and experiential learning is important in entrepreneurship education. Nonetheless, existing studies remain piecemeal and uncoordinated in the efforts to integrate AI into pedagogy for adults. The research proposed will fill this knowledge gap through the design and use of a framework using AI tools. The framework will build in experiential, constructivist, and adult learning principles. This framework seeks to

improve the design of entrepreneurship competencies, making both theoretical and practical contributions to higher education pedagogy. This fills an important gap in the literature and provides a basis for future empirical testing in university environments.

### **3. Research Methodology**

#### **3.1 Research Design**

This qualitative research design study aims to discover and develop a framework on adult pedagogy of the university level that integrates AI to develop entrepreneurship competencies. According to Creswell and Poeth (2018), a qualitative approach was selected because it would allow for an in-depth understanding of what the participants perceive, believe, know and experience, which is fundamental in designing pedagogical frameworks deriving from reality. The focus on subjective experiences and expert opinions matched the aim of the study, which was to derive a theoretically sound and contextually relevant framework for adult learners of various disciplines like education, mass communication, English, psychology and Urdu, at the University of Narowal.

#### **3.2 Population and Sampling**

The respondents of the study were faculty members and subject experts of the departments of Education, Mass Communication, English, Psychology and Urdu at the University of Narowal. These participants were selected for their experience teaching in higher education with entrepreneurship-related courses or innovative pedagogy. Purposive sampling was used in the study to recruit informed and knowledgeable participants whose accounts would provide rich data. In total, interview sessions were done with 15 participants, comprising 3 faculty members each. The sample size was determined according to data saturation, whereby the addition of interviews no longer resulted in a new theme. The participants were told about the purpose of the research and agreed to participate voluntarily.

#### **3.3 Data Collection Instruments**

The main data collection tool used was semi-structured interviews. The interview protocol was used to learn about participants' perceptions of effective adult pedagogy, entrepreneurship competencies and the use of AI in higher education. The interviews were conducted face-to-face with a duration of 45 to 60 minutes. All interviews were audiotaped and then transcribed verbatim. The semi-structured design allowed participants the freedom to express their views as well as enabling the researcher to probe further when appropriate. The questions were framed to carry out the research objectives, like determining the essential components of an AI-integrated pedagogy framework and getting familiar with pedagogical strategies used to develop entrepreneurship competencies.

### 3.4 Data Analysis

The interview data were examined through manual thematic analysis as indicated by Braun and Clarke (2006). Thematic analysis has different stages:

1. **Familiarization with data** – After reading the transcripts several times, the researcher decided to do this to find patterns and get initial impressions.
2. **Generating initial codes** – This could involve highlighting statements, concepts and experiences that are relevant to adult pedagogy, AI integration and entrepreneurship competencies.
3. **Searching for themes** – Codes were grouped into broader categories and themes that captured key patterns across responses.
4. **Reviewing themes** – Themes were refined to accurately represent the data and the research objectives.
5. **Defining and naming themes** – The last stage will be finalizing the theme labels and creating links with the theoretical framework and literature.

Through the use of a manual approach, the researcher was able to become intimately acquainted with the data and their interpretation. This approach also provides context to the findings and assesses the subtle nuances regarding adult learning and entrepreneurship pedagogy.

### 3.5 Research Procedures

The following steps were taken in carrying out the research:

1. Acquiring ethical clearance from the University of Narowal and getting consent from respondents.
2. Developing an interview guide from the literature review and theoretical foundations.
3. Professionally conduct interviews so the participants are comfortable.
4. Transcribe interviews word-for-word, and then sort them into groups for analysis.
5. Thematic Analysis will be carried out to identify patterns, categories, and insights for the framework.
6. Formulating a framework for adult education that incorporates AI-related solutions.

## 4. Data Analysis and Findings

A thematic analysis of the semi-structured interviews conducted with 15 faculty members from Education, Psychology, English, Urdu and Mass Communication departments was carried out to develop an autonomous learning-oriented model for adult entrepreneurship education in the digital age. The study discovered three main themes: Integration of Digital Tools into the Curriculum,

Learner-Centered Pedagogy and Competency-Based Assessment Strategies. Each of the themes had different sub-themes with quotations of the participants to substantiate them.

**RQ1:** *What are the key components of an AI-integrated adult pedagogy framework that effectively cultivates entrepreneurship competencies in university learners?*

## **Theme 1: Curriculum Integration of Digital Tools**

### **Sub-theme 1.1: AI-Enabled Learning Platforms**

According to the participants, it is essential to conduct independent learning through educational platforms using AI. Children can use these platforms to access materials that help them learn at their own pace and in accordance with their interests. *“AI-powered applications can adjust learning activities according to a child’s responses. This encourages kids to explore subjects at their own pace without overburdening the teacher.”* (Participant 3, Education). *“Interactive digital games that respond to children’s choices stimulate curiosity and decision-making skills”* (Participant 7, Psychology)

### **Sub-theme 1.2: Multimedia and Interactive Content**

Interviewees stated that multimedia content, such as animations, videos, and simulations, is essential to keeping learners engaged and enabling them to learn independently. *“Children can learn concepts through digital storytelling and animations, which provide them with stimulating visuals and reinforce their own thoughts.”* (Participant 10, English). *“Interactive simulations across math and language make students more confident trying things independently”* (Participant 1, Urdu)

## **Theme 2: Learner-Centered Pedagogy**

### **Sub-theme 2.1: Encouraging Curiosity and Exploration**

Faculty emphasized that autonomous learning models should focus on creating environments for children to explore as opposed to consume. *“Children should be given opportunities to ask questions, try different strategies and receive guidance only when necessary.”* (Participant 5, Education). *“A teacher’s role is more of a facilitator who observes and supports than someone who directs everything.”* (Participant 12, Psychology)

### **Sub-theme 2.2: Scaffolding and Support**

Even with self-directed learning, guidance was deemed necessary. Participants suggested scaffolding strategies as a function of children’s confidence. *“Significance of Scaffolding. At first, we guide the activities, and then children take over as soon as they can.”* (Participant 8, Education). *“Digital tools can offer guidance or feedback, which enables children to independently address and rectify mistakes. This is one strategy to encourage children to learn autonomously.”* (Participant 14, Mass Communication)

## **Theme 3: Competency-Based Assessment Strategies**

### **Sub-theme 3.1: Formative Feedback and Progress Monitoring**

Participants recommended the continuous assessment strategies to monitor developments without imposing pressure on learners. *“Children’s learning should be assessed through observation and digital logs instead of only through exams for understanding competency growth”* (Participant 2, Education). *“AI tools can track children’s learning patterns and highlight areas in which they require more help.”* (Participant 6, Psychology)

### **Sub-theme 3.2: Skill-Oriented Evaluation**

The model should measure competencies like problem-solving, creativity, collaboration, and digital fluency. *“Competency-based evaluation examines what children can do and not what they know, which is a match to autonomous learning.”* (Participant 9, Education). *“We need frameworks that show how children are getting smarter and more skilled, rather than just reporting grades. This motivates children to take ownership of their learning.”* (Participant 13, English)

The thematic analysis highlighted some considerations that designing the autonomous learning-oriented model for adult entrepreneurship education in the digital era requires:

1. The incorporation of artificial intelligence and digital tools to offer customized adaptive learning experiences.
2. Learner-centered pedagogy encourages exploration but also scaffolds to assist students with skill acquisition.
3. Competency-based assessments will be used to gauge overall development and not just learning skills.

The participants always stated that children learn autonomously with the help of tools enhanced by technology and exploration facilitated by the facilitator, as it allows for developing competencies in a flexible yet structured manner.

**RQ2:** *How does the application of this framework influence the development of core entrepreneurship competencies among adult students?*

The interview data were analyzed thematically to develop three themes, which included Enhancement of Entrepreneurial Knowledge and Skills, Creativity and Innovation and Self-efficacy and Decision Making in Entrepreneurial Contexts. The various themes had sub-themes, with direct quotations from the participants, showing the influence of the AI-integrated adult pedagogy framework on entrepreneurship competencies.

## **Theme 1: Enhancement of Entrepreneurial Knowledge and Skills**

### **Sub-theme 1.1: Business Planning and Market Understanding**

The framework is designed to help adult learners acquire useful skills, including business planning and financial competence, as well as market understanding. *“Students are trained to independently prepare business plans and analyze market trends through guided projects and AI simulations.”* (Participant 2, Education). *“The framework facilitates students experimenting with ideas in a virtual environment, boosting their knowledge of market needs and business operations.”* (Participant 6, Mass Communication)

### **Sub-theme 1.2: Practical Application of Theoretical Concepts**

Integrating experiential and autonomous learning helped them apply theory into practice in real-world scenarios. *“Students nowadays do not merely memorize entrepreneurship theories; they implement the theories through a simulated venture. This enables students to retain their skills and gain practical competence.”* (Participant 4, Psychology). *“AI tools give instant feedback about their decisions, linking theory and practice for students.”* (Participant 9, English)

## **Theme 2: Fostering Creativity and Innovation**

### **Sub-theme 2.1: Encouraging Ideation and Problem-Solving**

Teachers said that the framework was found to enhance innovative idea generation and problem-solving skills. *“The process of brainstorming, assessing, and refining ideas is solely done by the students.”* (Participant 3, Education). *“Students create solutions without fear of failure through simulated AI explorations of different scenarios.”* (Participant 12, Psychology)

### **Sub-theme 2.2: Experimentation and Risk-Taking**

The framework creates a safe testing space for entrepreneurial ideas, thus improving risk management. *“Several AI-based simulations enable students to put their concepts to the test while learning from their mistakes without incurring any financial losses in real life.”* (Participant 7, Urdu). *“The framework’s capacity for autonomous decision-making inspires confidence and risk-taking.”* (Participant 11, Mass Communication)

## **Theme 3: Self-Efficacy and Decision-Making in Entrepreneurial Contexts**

### **Sub-theme 3.1: Building Confidence and Independence**

Participants noted that adult learners took on entrepreneurial tasks with more confidence and autonomy. *“Students are confidently making decisions on business as they are becoming part of the process instead of being part of instruction.”* (Participant 1, Education). *“The autonomous learning components of the framework enhance the students’ belief in their capacity to do entrepreneurship.”* (Participant 8, Psychology)

### Sub-theme 3.2: Strategic and Critical thinking

The framework nurtured analytical skills that learners could use to make decisions. *“By performing scenario-based tasks, the learners acquire the skill of assessment and selecting the best strategies.”* (Participant 5, English). *“AI feedback prompts students to reflect on their choices, which enhances their strategic thinking and planning skills”* (Participant 14, Mass Communication)

The study found that the adult education framework embedding AI significantly impacts the development of core competencies in entrepreneurship. Key findings include:

1. **Knowledge and Skills Enhancement:** The students became more adept at business planning, understanding the market, and implementing theoretical concepts in practical life.
2. **Creativity and Innovation:** The framework enables ideation, problem-solving and taking safe risks, which is essential for entrepreneurship.
3. **Self-Efficacy and Decision-Making:** Learners acquired independence, assurance and strategic thinking, which enabled them to act like successful entrepreneurs.

Participants firmly argued that the combination of autonomous learning, AI tools and hands-on pedagogy is effective for building practical skills, creativity and independent decision making; therefore, it reinforces overall entrepreneurial competencies.

## 5. Discussion

The study aimed to design a framework that can be used at the university level, focusing on adult pedagogy that is relevant and suitable for nurturing entrepreneurship competency for the artificial intelligence (AI) age. Adult learning theory (andragogy), experiential learning theory, and social cognitive theory guided a study exploring how autonomous, AI-integrated pedagogical approaches contribute to the development of entrepreneurial skills, creativity and self-efficacy of adults. Semi-structured interviews with 15 faculty members were held. Manual thematic analysis of data revealed many significant insights connecting theory with practice.

### 5.1 Enhancement of Entrepreneurial Knowledge and Skills

The study showed that the framework greatly improved adult learners' actual business knowledge and skills. Participants stated that AI-enabled simulations lead students to develop skills in business planning, market analysis, and decision-making. As one participant explained: *“Through guided projects and AI simulations, students learn to independently prepare business plans and analyze market trends.”* (Participant 2, Education) Another noted: *“The framework encourages students to test ideas in virtual spheres, enhancing their understanding of market demand and business operations.”* (Participant 6, Mass Communication)

These findings corroborate Kolb's experiential learning theory (1984), which proposes that learning is enhanced through concrete experiences, reflective observation, and active experimentation. Adult learners' engagement with AI-based simulations aligned with andragogical principles of self-direction and problem-centered learning through bridging theory and practice (Knowles et al., 2015). The study's findings show that the integration of AI allows the establishment of a distinctive platform where learners can perform real-world entrepreneurial tasks while developing autonomous learning and decision-making.

## 5.2 Fostering Creativity and Innovation

The framework was found to contribute to adults' creativity and innovation. As a result of autonomous learning, participants engaged in independent idea generation and revisited the planning stage of their prototypes. *"Students are encouraged to generate, assess and rework ideas, which boosts creative thinking"* (Participant 3, Education). *"Through AI-based simulations, students can test out their ideas and learn from their mistakes without real money"* (Participant 7, Urdu)

The results are consistent with Bandura's social cognitive theory (1986) when self-efficacy motivates learners to undertake challenging tasks and develop innovative solutions. The risk-free environment made available by AI tools enables learners to experiment, take calculated risks, and modify strategies independently. The experiential learning theory, which suggests creativity grows when learners engage in problem-solving and do not receive knowledge passively, is supported by the framework's emphasis on autonomy and exploration.

## 5.3 Development of Self-Efficacy and Decision-Making

The structure also contributed to the self-efficacy of learners and their capacity to become strategic decision-makers. Participants consistently reported that learners grew in confidence and autonomy in entrepreneurial tasks: *"Students become more assertive about business choices by engaging in the decision-making process rather than just following instructions."* (Participant 1, Education). *"Through scenario-based tasks, the students develop the ability to critically assess the situation and choose the best strategy."* (Participant 5, English)

Results showed that the framework's autonomous learning component enhanced learners' self-efficacy or belief in their capabilities as prescribed by social cognitive theory. The self-assessment and decision-making of learners were reinforced through AI-driven feedback and reflection mechanisms, which further support iterative learning approaches for developing competence in the long term. These outcomes suggest that autonomy, guided exploration, and reflective feedback bolster entrepreneurial self-confidence and judgment.

## 5.4 Integration of AI with Adult Pedagogy

The investigation highlights the potential of incorporating artificial intelligence into adult education to benefit overall learning. AI tools were used as facilitators and enhancers of independent learning, including real-time feedback,

simulations and adaptive learning paths. According to the comments made by the participants, learners were able to get personalized learning that matched their pace, interest and skill level: *“Applications of AI facilitate automatic adjustment of learning activities, based on the learner’s responses, fostering exploration and independent problem-solving.”* (Participant 3, Education). *“Digital tools provide students with hints and structured feedback, enabling them to self-correct errors, which promotes independence and mastery.”* (Participant 14, Mass Communication)

Integration of andragogical principles refers to a process whereby learning becomes self-directing. It also encourages experiential learning, along with international opportunities to practice skills in safe, simulated environments while building confidence and competence.

## 5.5 Implications for Entrepreneurship Education

The findings suggest several practical implications:

1. **Curriculum Design:** The curriculum of entrepreneurship education should have practical modules and be enhanced with artificial intelligence capability-based learning.
2. **Autonomous Learning Strategies:** Adult learners benefit from structured pedagogical frameworks that also enable independent exploration and creativity to solve problems.
3. **Competency-Focused Assessment:** The evaluation of knowledge and skills through continuous feedback and AI-enabled monitoring promotes the focus on application and innovation and de-emphasizes rote learning.
4. **Faculty Role:** Teachers serve as guides who scaffold the learning process, allowing students to actively experiment and reflect, fostering students’ autonomy and skills.

These findings indicate that technology-enhanced, facilitated instructions lead to better technical skills and entrepreneurial skills like creativity, strategic thinking and self-efficacy in their entrepreneurial skills.

## 5.6 Contributions to Theory and Practice

This research helps to fill important research gaps in the current literature on adult education, entrepreneurship and artificial intelligence integration. To begin with, it proposes a framework that is both practical and grounded in theory for integrating AI technology into adult learning principles and entrepreneurship education. Although previous studies have looked at either the role of AI in education or adult learning in isolation, little has been written about a cohesive pedagogical model that meaningfully integrates these two domains in a structured and application-oriented manner. Recent research by Park et al. (2025) and Lim et al. (2022) revealed the need and importance of a holistic model for aligning technological innovation with the adult learning theory and the development of entrepreneurial skills. This framework builds

on the existing discourse in pedagogy by defining AI as a device that enables the formation of competencies in adults.

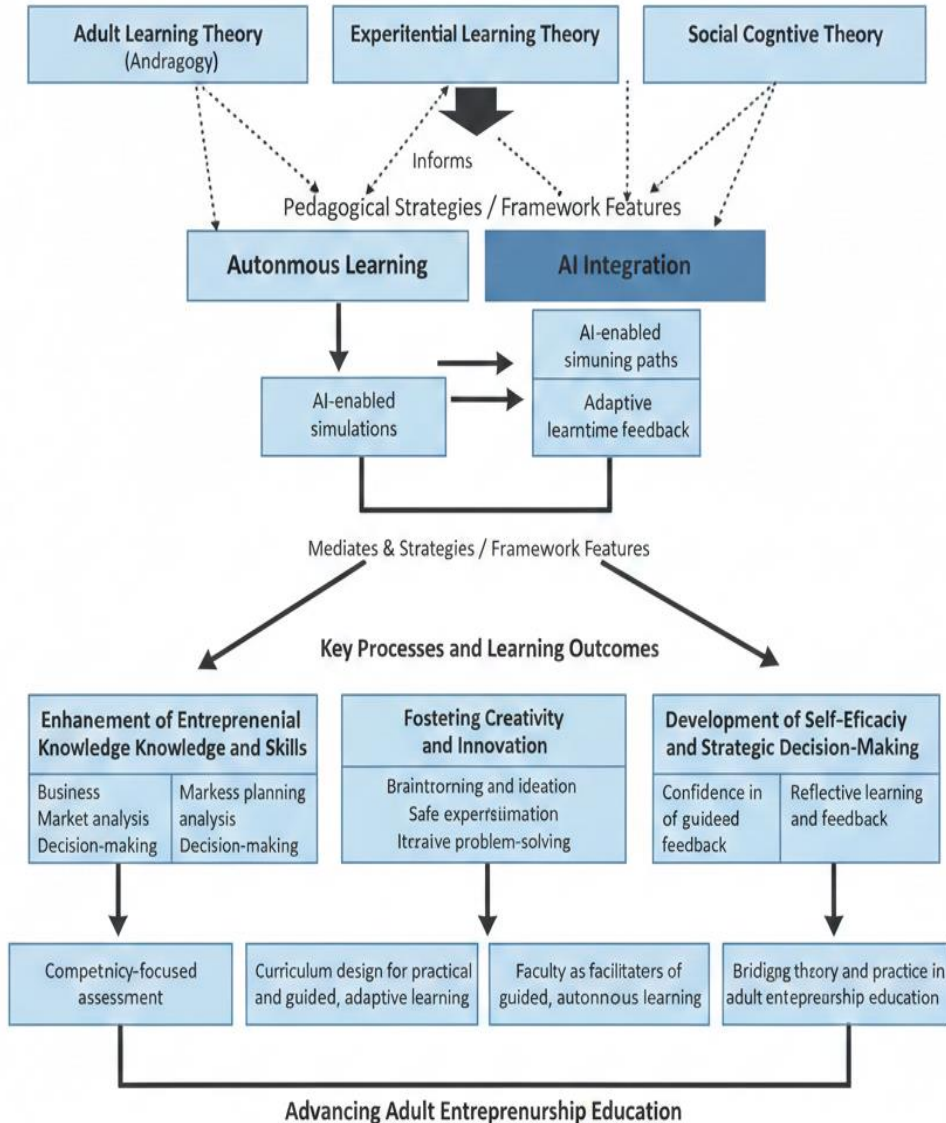
Secondly, the research shows that autonomous learning strategies aided by AI significantly improve both the development of competencies and learner self-efficacy. AI enables personalized learning experiences by employing adaptive feedback systems, intelligent tutoring, and data-driven learning pathways that support self-direction, goal setting, and reflection on learning. These activities correspond directly with the adult learner's need for autonomy and relevance, which enhances their confidence in their ability to perform entrepreneurial functions. The empirical findings appear to indicate that technology-mediated control contributes to cognitive skill development as well as motivational enhancement.

Third, the research confirms that experiential learning theory and social cognitive theory are applicable for use in the design of technology-enhanced adult pedagogy. In order to bridge the gap between theory and practice, the framework demonstrates how experiential actions such as problem-based learning, real-world simulations, and collaborative projects can be integrated in an AI-supported environment. Furthermore, the model includes a mechanism for observational learning, self-regulation and reciprocal interaction between learner and digital environments to ensure theoretical coherence. In sum, the study provides a framework for universities wishing to develop adult learning entrepreneurship competencies. AI is capable of creating a dynamic, adaptive and theory-informed environment that can help prepare adults for complex entrepreneurial contexts, showcasing the use of AI in an experiential and learner-centered approach.

## **5.7 Limitations and Future Directions**

In spite of the important findings, the study had drawbacks. The results may not be generalizable as the sample was limited to a single university. Knowing the perspectives of adult learners might offer a more balanced view from year to year. Future research could involve a wider sample from multiple institutions and collaboration for longitudinal research to track the long-term effect of AI-enhanced autonomous learning on entrepreneurial success. The framework developed after the findings is shown in Figure 2.

**Figure 2:** *AI Integrated Experiential and Autonomous Adult Entrepreneurship Pedagogy framework for university-level*



## 5.8 Conclusion

This study aims to develop a university-level adult pedagogy framework that cultivates entrepreneurial competencies, especially amid the advent of artificial intelligence (AI). This research work, guided by andragogy, experiential learning, and social cognitive theory, aims to assess the impact of autonomous learning and artificial intelligence (AI) infusion on adult learners' entrepreneurial knowledge, skills, creativity, and self-efficacy. Semi-structured interviews were conducted with 15

faculty members from the Education, Psychology, English, Urdu, and Mass Communication departments of the University of Narowal. The data were thematically analyzed using manual thematic analysis for salient patterns, themes, and sub-themes emergence. The results indicated that the framework proposed helped to a great extent support the entrepreneurial competency development. According to the participants, AI-based simulations/digital tools enable learners to solve real-life business challenges by applying theoretical knowledge and developing practical skills independently. One participant said: *“Through guided projects and AI simulations, students learn to independently prepare business plans and analyze market trends”* (Participant 2, Education). Experiential learning and andragogy theory agreement suggest that one should engage in experiential learning, which helps adults learn through self-directed, problem-centered learning (Knowles et al., 2015; Kolb, 1984).

According to the study, the framework helps enhance creativity and innovation through healthy ideas, experimentation, and problem-solving autonomously. When students did trials and errors using AI-generated feedback, this created a safe environment for this learning process. Moreover, participants indicated that learners’ self-efficacy and strategic decision-making improved under the autonomous learning structure, which resulted in learners being more confident and independent in entrepreneurial activities. These findings provide support for social cognitive theory, which posits that self-efficacy can drive motivation and competency (Bandura, 1986). The results indicate that the combination of AI and learner-centered pedagogy provides a comprehensive and flexible framework for entrepreneurship education from a practical point of view. The use of competency-based assessment strategies, continuous feedback and scaffolding guarantees that the adult learners not only acquire knowledge but also instill the confidence and skills necessary for entrepreneurship. According to the study, the key role of faculty as facilitators involves guiding, scaffolding and giving reflective feedback while allowing students to be in charge of their own learning.

Although these insights were valuable, the study was flawed. The sample was received from only one university and the views of the adult learners were missed. Future studies could include multiple institutions and student perspectives and be conducted longitudinally to assess the impact of AI-integrated autonomous learning on entrepreneurship over the long-term. The next studies may use cutting-edge large language models and any other emerging artificial intelligence tools to enhance creativity, decision-making, and innovation in entrepreneurial education. This research shows that a well-designed pedagogical framework to integrate AI can enhance entrepreneurship competencies by improving knowledge, creativity, self-efficacy and autonomous decision making. This framework helps higher education institutions to prepare adult learners to thrive in the 21st-century digital and entrepreneurial landscape by bridging theory and practice. The study contributes to theory and practice in adult education, AI-enhanced pedagogy and entrepreneurship development and lays the foundation for innovation in competency-based learning design.

## Recommendations

1. The adult entrepreneurship programs provided by the universities should make AI-based simulations, adaptive platforms and digital learning tools a part of them. Several learning tools are provided to learners by which they can engage in real-world business situations, take part in expanding their understanding and develop decision-making skills without a teacher. AI integration provides personalized learning and competency growth support.
2. Teaching strategies should be designed to develop learners who are autonomous, self-acting, and self-directed. The educators must be facilitators rather than directors. They need to provide scaffolding and pathways for students to take over learning. Creativity, critical thinking and entrepreneurial self-efficacy are fostered.
3. The assessment should be focused on practical entrepreneurial competencies, such as creativity, strategic decision-making, problem-solving, and self-efficacy. As the learning journey progresses, the students should be given feedback by the instructors and the AI tools to track progress, identify skill gaps, and improve students' skills.
4. Universities should introduce project-based as well as experiential learning activities such as simulation, case study and real-time entrepreneurial assignments. By undertaking these experiences, adult learners get to apply the concepts they have learned in practical situations. They learn from their mistakes without worrying about failure and gain confidence in their ability to do things.
5. Higher Education faculty should be trained in AI Technologies, Autonomous Learning and competency-based assessments. The faculty should be trained on how to assist adult learners using technology for entrepreneurship capabilities by the professional development program.
6. Future studies should assess how the use of AI in education impacts different entrepreneurial outcomes in the long run. Also, there should be research that investigates the emergence of technologies like large language models, VR and AI analytics for enhanced skills development and autonomous learning in adult learning.
7. Higher education institutions should formulate supportive policies and create a curriculum framework with flexibility for artificial intelligence incorporation, learner autonomy and competency-based evaluation to make adult learners ready for the digital and entrepreneurial economy.

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