International Journal of Pedagogics

VOLUME Vol.05 Issue03 2025
PAGE NO. 107-111
DOI 10.37547/ijp/Volume05Issue03-31

Indicators for Assessing Entrepreneurial Competencies of Students in Technical Sciences

Butayev Tuxtasin

Associate Professor, PhD, Kokand Branch of Tashkent State Technical University, Uzbekistan

Received: 28 January 2025; **Accepted:** 27 February 2025; **Published:** 21 March 2025

Abstract: This article examines pedagogical technologies aimed at developing and fostering entrepreneurial competencies among students in engineering education, their content, and methodological foundations. The study analyzes the stages of implementing these technologies, their advantages, and disadvantages. Additionally, it outlines measures for integrating these technologies into engineering education. The research findings enable the planning of elective and additional courses in engineering education in accordance with modern labor market requirements through the development of students' entrepreneurial competencies.

Keywords: Technology, engineering education, entrepreneurial competence, engineering business, business idea, business group, startup project, creativity, innovation.

Introduction: Within the framework of the research work, one of the main tasks was identified as determining and analyzing the indicators of entrepreneurial competence of students in engineering fields [1, 2].

It is known that in economics, an indicator is understood as a numerical measure that reflects changes in one or more economic or financial values, while in chemistry, it refers to a substance added to a studied solution to detect a chemical process (color change, dissolution of a precipitate), serving as an indicator of acid-base reactions [3, 4].

In social sciences or sociology, an indicator (from Latin indicātor – pointer) is understood as a tool, device, or information system used to observe an object under study and measure changes occurring during the observation process. It is a set of parameters developed to directly investigate and evaluate changes in relation to other characteristics of the object [5, 6, 7].

Research Methods. Based on the specific characteristics of teaching specialized subjects to students at various stages of engineering education, as well as the qualification requirements and competence demands placed on the professional preparation of students in technical fields, we propose the following as the main indicators of entrepreneurial competence for students in engineering education fields [8] (see Figure 1):

The term “Opportunity Seeking and Initiative Indicator” refers to the ability to identify, evaluate, and take initiative in seizing new opportunities by utilizing changing conditions, resources, and information [9]. These indicators may be based on various factors and can include the following:

-Market Research: Analyzing the market, industry, and competition to identify changes and new opportunities [10].

-Adoption of New Ideas: Supporting new and innovative ideas and allocating resources for their implementation [11].

-Creativity: Thinking outside conventional approaches to identify new opportunities and develop innovative solutions [12].

-Research and Development: Continuously exploring to develop new products, services, or systems.

-Initiating Action: Identifying problems, proposing solutions, and leading the implementation of new projects.

-Risk Readiness: Accepting and managing certain risks to create new opportunities.

-Starting and Completing Tasks: Overcoming challenges, initiating processes, and seeing them through to completion.

-Leadership in Management: Proactive individuals typically inspire and lead their teams or employees toward new tasks.

Leadership Indicator: Derived from the English word leader (guide, pioneer), this manifests in the social influence process of uniting the efforts and actions of others to achieve a common goal. Leadership and leading involve the ability to manage and direct a team toward realizing objectives. These concepts are relevant across many social, business, and political domains, each with its own specific indicators (defining factors).

A leader is an individual who manifests themselves, is respected, and inspires others. Implementing changes and promoting new ideas. The ability to influence others in their thinking and decision-making. Attentive and effective communication, actively listening to and understanding others. Making correct and efficient decisions in various situations. Managing the daily operations of an organization, allocating resources, and motivating the team to achieve common goals. Resolving conflicts and disputes that may arise within the team. Effectively allocating resources and managing team activities. Inspiring and motivating the team to achieve high performance. Effectively solving unexpected problems. Enhancing the potential of team members and encouraging their growth.

Adaptability to Change (Risk Management) Indicator:

The adaptability to change (risk management) indicator is a critical aspect of management, as changes and uncertainties are ever-present in business and entrepreneurial activities. Adaptability to change refers to the process of quickly responding to and adjusting to new situations, market conditions, or technological innovations.

Risk management, on the other hand, involves identifying, assessing, and mitigating potential risks through decision-making to reduce and control these risks.

- Indicators of Adaptability to Change and Risk Management:

a. Adaptability to Change:

o Rapid Decision-Making: Making quick and accurate decisions in dynamic conditions and taking action.

o Resource Redistribution: Efficiently reallocating and updating resources based on circumstances.

b. Risk Management:

o Risk Analysis: Identifying and analyzing potential risks.

o Risk Mitigation Strategies: Developing strategies to reduce or prevent risks.

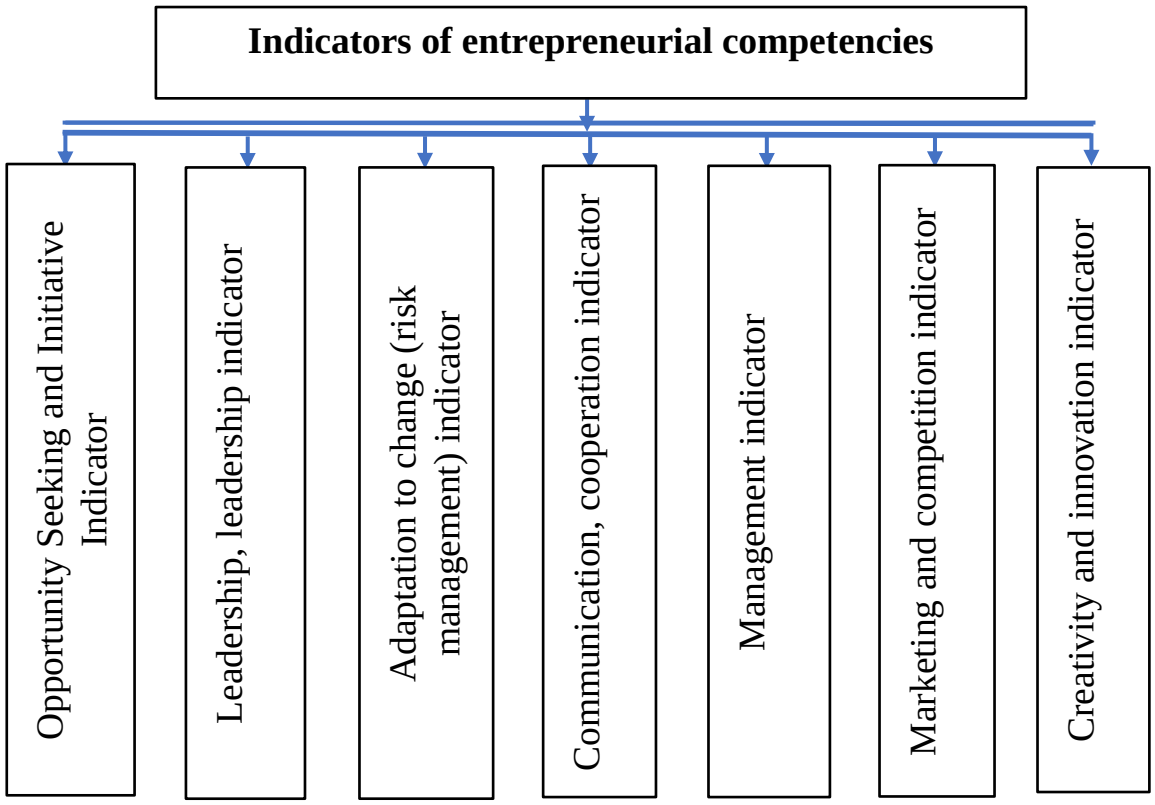

Figure 1. Indicators of student entrepreneurial competencies.

The Adaptability to Change and Risk Management Indicator plays a vital role in the effective development of entrepreneurship or a team. An entrepreneur can sustain their activities by adapting to changing market

conditions and managing potential risks. Through these indicators, entrepreneurs continuously seek new opportunities and ways to avoid risks.

Communication and Collaboration Indicator: The communication and collaboration indicator refers to concepts that play a crucial role in facilitating the exchange of ideas, sharing resources, and working together toward a common goal among individuals. An effective communication and collaboration indicator impacts an entrepreneur's success, team workflows, and inter-organizational relationships.

In communication, clear and efficient idea exchange, listening, understanding, and conveying one's thoughts to others are highly important. Collaboration refers to working together, pooling resources, and fostering cohesion among group or team members to achieve a shared objective.

Communication and Collaboration Indicators:

o Clarity and Precision: Conveying ideas and information in an accessible and understandable manner.

o Active Listening: Fully listening to and striving to understand others when they speak.

o Idea Exchange: Openly expressing thoughts and engaging in dialogue with others.

o Teamwork: Team members' readiness to collaborate, support each other, and share ideas.

o Flexibility: Accepting diverse opinions and integrating them with one's own.

o Empathy and Support: Understanding team members' needs and being ready to assist.

Effective communication and collaboration are key indicators of an entrepreneur's success, contributing to an improved overall work environment. Developing these skills enhances teamwork within an organization and simplifies the process of achieving common goals.

The Management Indicator is used to assess an entrepreneur's or manager's ability to effectively plan and manage business projects. These indicators help the entrepreneur utilize resources, time, and energy in the most beneficial way possible.

Key Management Indicators:

o Efficient Data and Resource Management: Optimally allocating resources, time, and funds.

o Decision-Making: How quickly and effectively decisions are made, reflecting how the organization adapts to changing conditions.

o Performance Analysis: Analyzing business processes and outcomes, identifying errors, and correcting them.

o Cost Management: Efforts to reduce costs and conserve resources.

o Resource Management: Skills in efficiently distributing and managing financial, human, and other necessary resources.

o Financial Planning: The ability to analyze the business's financial condition and develop effective financial plans.

o Project Management: Skills in managing and overseeing various projects, effectively utilizing time and resources.

Management indicators are critical measures for assessing and improving success across different areas of an organization. Each of these indicators represents various skills and abilities necessary for successfully managing and developing a business. These skills contribute to the stability and growth of the business and ensure the entrepreneur's successful performance.

Marketing and Competition concepts are of great importance for achieving success in the business world. Both play a significant role in an entrepreneur's strategic decision-making, successful promotion of products or services in the market, and increasing competitiveness.

Marketing: This encompasses a set of activities that include creating a product or service, launching it into the market, promoting it, and selling it. Key aspects of marketing include:

o Market Research: Studying customer needs, market trends, and competition.

o Product Development: Creating a product or service to meet customer demands.

o Pricing: Setting a competitive price to ensure the product's acceptance and sale in the market.

o Promotion Activities: Advertising the product or service, building brand recognition, and delivering it to customers.

Competition: This refers to the process in which multiple entrepreneurs entering the market compete to gain customers' attention through their products or services. The dynamic conditions of competition affect the growth, development, and success of a business. Key factors of competition include:

o Price and Quality: Differences in price and quality between competitors serve as primary tools of competition.

o Innovations: A company can enhance its competitiveness by creating new technologies and products.

o Brand Image and Advertising: Building a

recognizable brand and fostering consumer trust provide a competitive advantage.

The Creativity and Innovation Indicator measures an entrepreneur's or individual's ability to generate, refine, and apply new ideas. Creativity and innovation lie at the heart of successful entrepreneurship and management systems, being essential for effective development and adaptation to market demands. Below are the concepts and key aspects of the creativity and innovation indicator:

Creativity: This is the ability to generate new and original ideas, encompassing the resolution of existing problems through novel approaches. Creativity indicators include:

o Idea Generation: Proposing innovative and original solutions to problems.

o Creative Thinking: Thinking creatively across various directions, discovering new opportunities, and testing new methods.

Innovation: This is the process of applying and introducing new ideas, products, services, or processes. Innovation indicators include:

o New Product or Service Creation: Developing and launching a new product or service into the market.

o Process Improvement: Enhancing production or service delivery processes using innovative methods.

o Technology Adoption: Implementing new technologies, updating, or refining existing ones.

o Openness to Change: Actively engaging with new ideas, perspectives, and technologies and working with them.

The indicators listed above enable the assessment of a student's entrepreneurial activities and entrepreneurial characteristics. Analyzing these indicators based on distribution across one or multiple levels allows for the creation of a specific diagnostic card for each student. Diagnostic cards serve as a primary tool for developing and evaluating a student's entrepreneurial competence.

Research Findings: Based on the variable indicators developed for identifying and assessing entrepreneurship, we utilized a range of methodologies and questionnaires within the framework of pedagogical experimental studies to evaluate students' entrepreneurial abilities.

The "Entrepreneurship Test" was applied to determine students' entrepreneurial levels, their entrepreneurial potential, and creative capacities. Students' entrepreneurial competencies were studied at the beginning and end of the experiment (see Figures 2 and 3).

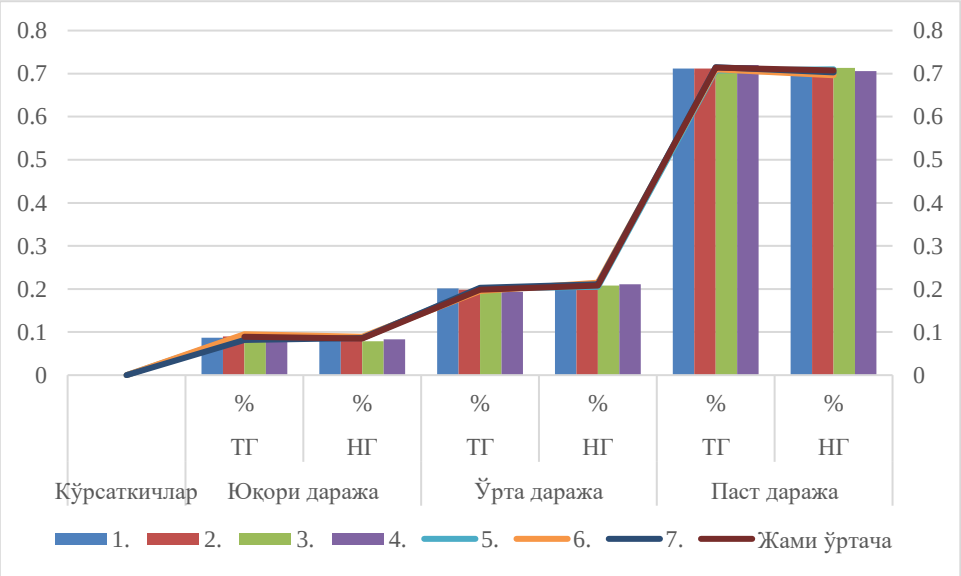

Figure 1. Entrepreneurship indicators at the beginning of the experiment

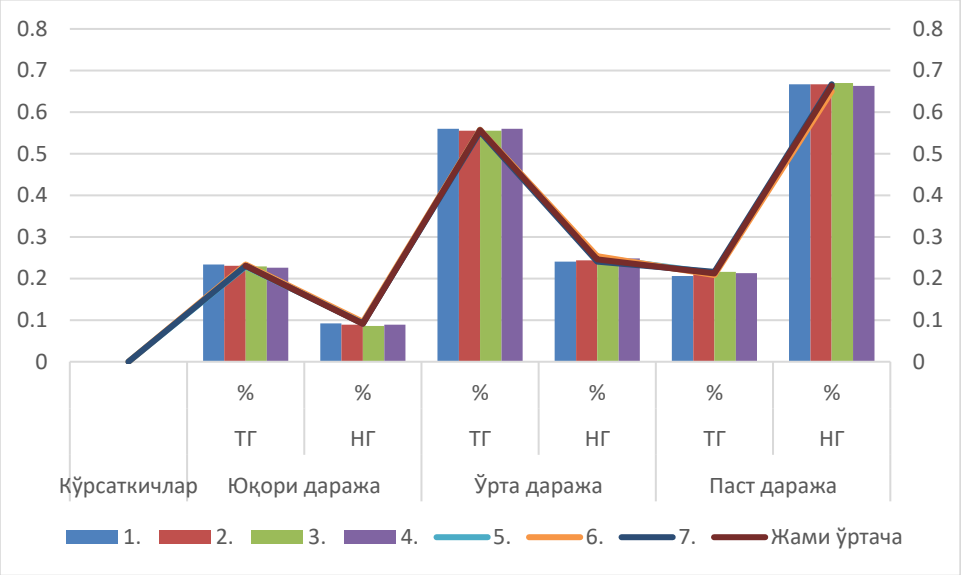

Figure 2. Entrepreneurship indicators at the end of the experiment.

Here: 1 – Opportunity Seeking and Initiative; 2 – Leadership; 3 – Adaptability to Change; 4 – Communication and Collaboration; 5 – Management; 6 – Marketing and Competition; 7 – Creativity and Innovation

Conclusion. This article examines the issues of developing and enhancing entrepreneurial competencies among students in engineering education programs. During the research process, the stages of implementing pedagogical technologies, their advantages and disadvantages were analyzed, and practical measures for applying these technologies in engineering education were proposed. Key indicators of entrepreneurial competencies were identified, including searching for opportunities, initiative, leadership, adaptation to changes, communication, management, marketing, and creativity. According to the research results, developing entrepreneurial skills in students helps align the content of engineering education with the requirements of the modern labor market and enhances their professional preparedness. This approach fosters the development of innovative ideas and startup projects in the engineering field while also increasing students' competitiveness. In the future, there is potential to extend these methods to other

REFERENCES

Smith, J. A., & Brown, R. T. (2020). Entrepreneurial competence in engineering education: A systematic review. Journal of Engineering Education, 109(3), 456–472.

Lee, K. M., & Patel, S. (2022). Assessing entrepreneurial skills among engineering students: Indicators and frameworks. International Journal of Innovation Studies, 6(4), 231–245.

Johnson, P. L., & Taylor, M. E. (2019). Economic indicators: Theory and application in financial analysis. Journal of Economic Studies, 46(5), 890–905.

Clark, H. R., & Nguyen, T. V. (2021). Chemical indicators in analytical chemistry: Principles and practices. Chemistry Review, 33(2), 123–140.

Davis, R. K., & Thompson, L. M. (2018). Indicators in social research: Tools for measurement and evaluation. Sociological Methods & Research, 47(3), 321–345.

Martinez, S. P. (2020). Sociological indicators: Concepts and applications in observational studies. Journal of Social Sciences, 15(2), 89–104.

Brown, A. J., & Patel, N. K. (2023). Parameters of change: Developing indicators for social analysis. Contemporary Sociology, 52(4), 567–582.

Thompson, E. R., & Kim, J. H. (2022). Entrepreneurial competence in engineering education: Indicators and professional preparation. Journal of Technical Education and Training, 14(1), 78–92.

Carter, L. M., & Evans, P. D. (2021). Opportunity seeking and initiative: A framework for entrepreneurial success. Entrepreneurship Theory and Practice, 45(3), 512–530.

Patel, R. K., & Singh, V. (2020). Market research as a tool for identifying entrepreneurial opportunities. Journal of Business Strategy, 41(4), 67–82.

Nguyen, H. T., & Lopez, M. A. (2019). Innovation and resource allocation: Adopting new ideas in entrepreneurial ventures. International Journal of Innovation Management, 23(5), 345–360.

Kim, S. Y., & Roberts, J. E. (2022). Creativity in entrepreneurship: Thinking beyond conventional solutions. Journal of Creative Behavior, 56(2), 189–205