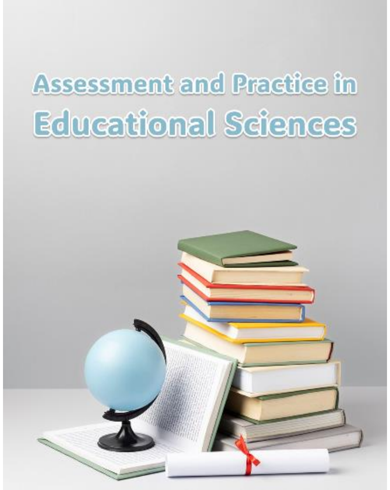
Assessment and Practice in Educational Sciences



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Article type:
Original Research

Article history:
Received 09 June 2026
Revised 03 September 2026
Accepted 12 September 2026
Initial Publish 03 October 2026
Published online 01 January 2027

How to cite this article:
Hashemi, S. R., Esmaeli, N., & Afkaneh, S. (2027). Validation of the Proposed Entrepreneurship-Oriented Curriculum Model with an Artificial Intelligence Approach in Universities of Mazandaran Province. *Assessment and Practice in Educational Sciences*, *5*(1), 1-16. https://doi.org/10.61838/japes.321

Validation of the Proposed Entrepreneurship-Oriented Curriculum Model with an Artificial Intelligence Approach in Universities of Mazandaran Province

ABSTRACT

The present study aimed to validate a proposed entrepreneurship-oriented curriculum model incorporating an artificial intelligence approach in universities of Mazandaran Province. In terms of purpose, this study was applied, and in terms of methodology, it employed a descriptive-survey design conducted as the quantitative phase of the sequential exploratory mixed-methods design of the main research project. The statistical population consisted of 2,578 faculty members from universities and higher education institutions in Mazandaran Province. Using Cochran's formula and proportionate stratified random sampling, 334 participants were selected as the study sample. The research instrument was a researcher-developed 72-item questionnaire derived from the seven-dimensional conceptual model obtained in the qualitative phase of the study. The reliability of the instrument was confirmed at a satisfactory level, with a Cronbach's alpha coefficient of .949 for the total scale and coefficients ranging from .850 to .961 for the seven dimensions. Data were analyzed using the one-sample t test, Friedman test, and confirmatory factor analysis (CFA). The results of the one-sample t test indicated that the means of all seven model dimensions were significantly higher than the theoretical criterion mean of 3 ($p < .001$ in all cases), providing empirical support for the content and empirical validity of the proposed model from the perspective of faculty members. The Friedman test further showed that the dimensions of "Infrastructure, Faculty, and Organizational Support Ecosystem" (mean rank = 3.22) and "Smart Curriculum Design and Structure" (mean rank = 3.59) received the highest priorities, whereas "Active and Applied Learning" (mean rank = 4.82) received the lowest relative priority among the seven dimensions, $\chi^2 = 114.60$, $p < .001$. The findings of the confirmatory factor analysis also provided relative support for the factor structure of the model. Based on the findings, the seven-dimensional entrepreneurship-oriented curriculum model incorporating an artificial intelligence approach possesses the necessary empirical validity for use in curriculum policymaking and design in universities of Mazandaran Province.

Keywords: validation, curriculum, entrepreneurship, artificial intelligence, confirmatory factor analysis, higher education

Introduction

Higher education systems are increasingly expected to prepare graduates for economic environments characterized by technological disruption, rapid knowledge obsolescence, changing occupational structures, and growing uncertainty in labor markets. Within this context, entrepreneurship education has moved beyond the narrow objective of preparing students to establish new businesses and has increasingly been conceptualized as a means of developing opportunity recognition, innovation, initiative, problem-solving, risk management, adaptability, and value-creation capabilities. Universities are therefore under growing pressure to reconsider the extent to which their curricula cultivate entrepreneurial competencies that enable students not only to enter existing labor markets but also to actively shape new forms of economic and social activity. Recent studies have consequently emphasized that entrepreneurship education should be embedded systematically in curriculum goals, content, pedagogical practices, learning experiences, assessment processes, and institutional support mechanisms rather than being treated as an isolated course or extracurricular activity (1-3).

The importance of curriculum in entrepreneurship education stems from the fact that entrepreneurial behavior does not emerge merely through exposure to theoretical knowledge. A curriculum capable of fostering entrepreneurship must create coherent relationships among learning objectives, disciplinary and interdisciplinary content, active learning strategies, authentic entrepreneurial experiences, assessment practices, faculty competencies, and the broader university ecosystem. Research on entrepreneurship curricula has shown that students' entrepreneurial intentions and behavioral orientations are influenced by the quality and relevance of curricular support, particularly when formal instruction is accompanied by experiential opportunities and a supportive institutional environment (4, 5). Similarly, the effectiveness of entrepreneurship education depends substantially on the pedagogical competence of instructors and their ability to move from conventional transmission-oriented teaching toward facilitation, mentoring, problem-based learning, and experience-centered instruction (6). Curriculum development in entrepreneurship thus requires a systemic perspective in which individual curriculum elements operate as an integrated configuration rather than as disconnected instructional activities.

This systemic understanding has also been reflected in attempts to construct curriculum models specifically suited to entrepreneurship education. For example, entrepreneurship curriculum design has been examined through models that emphasize coherence among curriculum components and their contextual relationships, including frameworks derived from Akker's curriculum spider-web approach (7). In the Iranian higher education context, efforts have likewise been made to identify appropriate models of entrepreneurial teaching and to adapt educational strategies to the institutional, cultural, and pedagogical characteristics of universities (8). More recent research has extended this line of inquiry by emphasizing entrepreneurial thinking as a foundational orientation that should permeate curriculum design and learning processes rather than being limited to business-startup knowledge (9). These developments indicate an ongoing shift from teaching "about entrepreneurship" toward designing curricula that enable students to think, act, collaborate, experiment, and create value entrepreneurially.

Nevertheless, entrepreneurship curricula remain subject to important conceptual and practical debates. One concern is whether contemporary curriculum reforms represent a substantive transformation in the educational purposes and learning architecture of entrepreneurship education or merely incremental modifications to existing business and management education structures (10). If entrepreneurship education is reduced to conventional instruction in business plans, finance, marketing, and management techniques, its capacity to develop adaptive entrepreneurial agency may remain limited. Conversely, curricula that excessively emphasize general entrepreneurial attitudes without sufficient disciplinary, technological, analytical, and practical foundations may fail to prepare students for the complexity of contemporary innovation ecosystems. Evidence from practitioners suggests that effective entrepreneurship education requires stronger connections between universities and real entrepreneurial environments, greater use of authentic challenges, interaction with entrepreneurs and industry actors, and continuous revision of curriculum content in response to emerging economic realities (11). Furthermore, student characteristics and preferences may influence how entrepreneurship curriculum experiences are perceived and how learners engage with educational content, suggesting that flexible and learner-responsive curriculum design is increasingly important (12).

These curriculum challenges have become considerably more complex with the rapid expansion of artificial intelligence (AI). AI is no longer simply an auxiliary digital technology used to automate isolated educational functions; it is becoming a transformative force affecting the production, organization, personalization, delivery, and evaluation of knowledge across higher education. Global evidence indicates that AI can influence numerous dimensions of curriculum development, including learning objectives, content selection, teaching methods, personalized learning pathways, assessment practices, faculty roles, and institutional decision-making (13). Accordingly, curriculum development in the AI era requires universities to reconsider both what students need to learn and how learning itself should be organized. The accelerating integration of generative AI, intelligent tutoring systems, learning analytics, adaptive educational environments, and data-driven decision-support mechanisms has generated new possibilities for responsiveness and personalization while simultaneously raising challenges related to academic integrity, human agency, ethics, data governance, and educational equity.

From a curriculum-theory perspective, AI therefore cannot be adequately understood merely as an instructional tool added to an otherwise unchanged educational system. A broader conceptualization regards AI as part of a changing social, technological, and civilizational context in which the assumptions underlying curriculum, knowledge, learning, and human development must be reconsidered (14). This perspective is particularly relevant because curriculum adaptation in the age of AI involves continuous negotiation between technological capabilities and educational values. Curriculum designers must determine which learning processes can beneficially be supported or augmented by AI, which human competencies should remain central, and how students can develop the critical capacity to interact with intelligent systems responsibly and productively. Research on curriculum adaptation has accordingly highlighted the need for responsive, context-sensitive models capable of incorporating AI-related changes while preserving pedagogical coherence and educational purpose (15).

The emerging literature further demonstrates that AI offers significant opportunities for curriculum personalization. AI-supported curriculum design can facilitate the analysis of learner characteristics, educational needs, prior performance, and learning patterns, enabling differentiated learning pathways and more individualized educational experiences (16). Meta-synthesis research has similarly identified multiple roles for AI in curriculum design, including needs assessment, content organization, learning-resource selection, instructional adaptation, assessment, and feedback (17). At the level of specific disciplinary curricula, research has also examined the requirements for integrating AI into science education and has emphasized the importance of infrastructure, teacher readiness, content redesign, ethical considerations, and organizational preparation (18). Other research syntheses concerning science curricula have likewise demonstrated that AI integration affects several interrelated curriculum components and therefore requires systematic rather than piecemeal implementation (19).

At the same time, the integration of AI into educational curricula is accompanied by significant challenges. Reviews of AI-based teacher education curricula have identified both opportunities and constraints related to technological infrastructure, professional preparedness, pedagogical knowledge, ethical concerns, unequal access, resistance to change, and institutional capacity (20). These issues are particularly consequential in higher education because successful curricular transformation depends not only on access to AI technologies but also on the readiness of faculty members to redesign learning experiences around them. Faculty must be capable of understanding the pedagogical affordances and limitations of AI, guiding students in critical and ethical use, interpreting data generated by intelligent systems, and redesigning assessment in ways that maintain authentic learning. Thus, AI-based curriculum innovation requires simultaneous attention to technology, human expertise, organizational policy, and educational culture.

The convergence of AI and entrepreneurship education creates an especially significant field for curriculum innovation. Contemporary entrepreneurship is increasingly mediated by digital platforms, data analytics, intelligent automation, algorithmic decision-making, and emerging technologies. AI can reduce informational barriers, support opportunity identification, improve market analysis, facilitate product and service design, automate routine entrepreneurial tasks, and enable novel business models. Emerging technologies such as AI and blockchain are also reshaping intermediary organizations and mechanisms that support entrepreneurship development, further changing the competencies expected of future entrepreneurs (21). Consequently, entrepreneurship curricula that remain disconnected from AI-related knowledge and capabilities risk becoming increasingly misaligned with the realities of entrepreneurial activity.

The relationship between AI learning and entrepreneurship is not limited to technical proficiency. Evidence suggests that AI learning and digital literacy may contribute to entrepreneurial behavior through psychological and behavioral mechanisms such as entrepreneurial self-efficacy (22). This relationship is important because entrepreneurial competence in AI-intensive environments requires a combination of technical, cognitive, behavioral, interpersonal, and ethical capabilities. Students need to understand how AI and data can support entrepreneurial decision-making while simultaneously developing creativity, critical thinking, initiative, communication, teamwork, resilience, ethical judgment, and the ability to identify and evaluate opportunities. An entrepreneurship-oriented curriculum with an AI approach should therefore not be interpreted as merely adding AI-related content to traditional entrepreneurship courses; rather, it should integrate technological and data competencies with entrepreneurial and human capabilities in a coherent curriculum architecture.

The pedagogical implications of this integration are equally important. Entrepreneurship is fundamentally action-oriented, and AI-related competence also develops most effectively through active engagement rather than exclusively through lectures or conceptual instruction. Project-based learning, problem-based learning, simulation, prototyping, case analysis, interdisciplinary teamwork, interaction with entrepreneurial ecosystems, and technology-supported experimentation can provide students with opportunities to apply both entrepreneurial and AI-related knowledge to authentic problems. Integrated educational frameworks, including those drawing upon interdisciplinary STEAM approaches, have highlighted the potential value of combining creativity, technology, problem-solving, and entrepreneurship through coherent curriculum structures (23). In such settings, students can move from passive recipients of information toward active designers of solutions and entrepreneurial opportunities.

However, active and technology-intensive curricula cannot be implemented successfully without supportive organizational conditions. AI-integrated entrepreneurship education requires access to appropriate digital infrastructure, data resources, software platforms, laboratories, networks, technical support, and flexible learning environments. Equally important are faculty development, managerial commitment, supportive regulations, institutional incentives, and connections with external entrepreneurial actors. A technically sophisticated curriculum may remain ineffective if instructors lack the competence or motivation to implement it, just as competent instructors may be constrained by inadequate infrastructure or rigid institutional processes. This implies that curriculum validity should be examined not merely in terms of content relevance but also with regard to the feasibility and perceived importance of institutional and ecosystem conditions necessary for implementation.

Another important concern is evaluation. Traditional assessment approaches based primarily on examinations and reproduction of information are often inconsistent with the intended outcomes of entrepreneurship and AI education. If curricula are expected to cultivate opportunity recognition, problem-solving, innovation, AI literacy, data-informed reasoning, collaboration, and entrepreneurial action, assessment must capture these complex competencies through performance-based and authentic methods. Curriculum evaluation should therefore encompass both learning processes and multidimensional outcomes, including students' entrepreneurial competencies, self-efficacy, technological capability, innovative behavior, and capacity to transfer learning to real-world settings. The validation of entrepreneurship-oriented curriculum models is especially important because conceptual desirability alone does not establish that a proposed framework is sufficiently coherent, relevant, or acceptable to those responsible for its implementation. Previous research validating entrepreneurship education curriculum models has demonstrated the value of empirical assessment in determining whether theoretically derived curriculum structures are supported by educational stakeholders (24).

Research on higher education entrepreneurship also indicates that entrepreneurial outcomes are influenced by interactions among curriculum, learner characteristics, mindset, opportunities, and perceptions of risk. Entrepreneurial intention can be strengthened when curriculum experiences are combined with optimism, opportunity perception, and appropriate awareness of entrepreneurial risk (25). Similarly, the effects of entrepreneurship education and curriculum may depend partly on students' entrepreneurial mindsets, demonstrating that curriculum design should consider not only the transmission of content but also the development of cognitive orientations that shape entrepreneurial action (5). Such findings reinforce the need for multidimensional curriculum models that incorporate competency development, learning processes, contextual supports, and intended outcomes rather than relying on a narrow content-based conception of entrepreneurship education.

Despite the growing bodies of scholarship on entrepreneurship curricula and AI-supported curriculum development, these two domains have frequently evolved along parallel rather than fully integrated trajectories. Entrepreneurship curriculum research has concentrated on entrepreneurial intention, pedagogy, experiential learning, curriculum components, and institutional support (4, 6), whereas AI curriculum research has emphasized technological integration, personalization, digital literacy, instructional adaptation, and the changing role of educators (13, 15). The intersection of these fields remains comparatively underdeveloped, especially with respect to empirically validated models that specify how entrepreneurial competencies, AI and data competencies, curriculum structure, active learning, human and professional competencies, organizational infrastructure, and evaluation can operate within a unified framework. This gap is particularly consequential for universities attempting to respond simultaneously to digital transformation and expectations regarding employability, innovation, entrepreneurship, and regional development.

The need for contextual validation is also critical. Curriculum models developed in one national, institutional, or disciplinary environment cannot automatically be assumed to possess equal relevance in another context. Universities differ in technological readiness, faculty capabilities, organizational culture, governance arrangements, student characteristics, industry relationships, and access to entrepreneurial ecosystems. Iranian higher education has its own institutional and educational conditions, and previous national studies have emphasized the importance of constructing entrepreneurship-oriented teaching and curriculum models compatible with these conditions (8, 9). At the same time, the growing national interest in AI-supported curriculum design has generated research addressing personalized curricula, disciplinary applications, and curriculum requirements (16, 18, 19). Yet empirical evidence concerning an integrated entrepreneurship-oriented curriculum incorporating AI at the university level remains limited.

Mazandaran Province provides a meaningful setting for examining this issue because its higher education system encompasses diverse universities and institutions with different missions, disciplinary orientations, organizational structures, and technological capacities. A curriculum model intended for application across this environment must therefore demonstrate not only conceptual coherence but also empirical acceptability among faculty members who possess direct knowledge of educational practices and institutional conditions. Faculty perspectives are particularly important because instructors function as key agents of curriculum implementation: they interpret curriculum goals, select pedagogical practices, integrate technologies, assess learning outcomes, and mediate between formal curriculum intentions and students' actual educational experiences. Empirical validation from the perspective of faculty members can therefore provide essential evidence regarding whether the dimensions identified through qualitative inquiry are perceived as sufficiently important and relevant for university curriculum development.

Moreover, the contemporary complexity of entrepreneurship and AI requires curriculum validation at multiple levels. Internal reliability can indicate whether the dimensions are measured consistently; comparisons of dimension scores against a theoretical criterion can indicate the extent to which stakeholders endorse the proposed components; priority analysis can identify which dimensions are regarded as more urgent for implementation; and factor-analytic evidence can determine the degree to which empirical data support the hypothesized multidimensional structure. Bringing these forms of evidence together provides a more defensible basis for curriculum policymaking than relying exclusively on qualitative conceptualization or expert judgment. Such validation is particularly necessary when a proposed model is intended to inform institutional planning, faculty development, technological investment, instructional redesign, and assessment policies.

Accordingly, the emerging literature points toward a clear need for entrepreneurship curricula that are technologically informed, pedagogically active, competency-based, human-centered, context-sensitive, and institutionally supported. AI can expand the capacity of universities to personalize learning, analyze educational data, create adaptive experiences, and expose students to technologies increasingly central to entrepreneurial activity, but its educational value depends on purposeful curriculum design rather than technology adoption alone (14, 17). Entrepreneurship education, in turn, can foster the agency, innovation, opportunity orientation, and value-creation capabilities needed to apply technological knowledge meaningfully in changing economic environments (3, 11). Integrating these two domains therefore represents not merely an addition of new content but a substantive reconsideration of curriculum objectives, learning experiences, competencies, institutional resources, faculty roles, and educational outcomes.

Therefore, the present study aimed to validate the proposed entrepreneurship-oriented curriculum model incorporating an artificial intelligence approach in universities of Mazandaran Province.

Methods and Materials

In terms of purpose, the present study was applied, and in terms of data collection, it employed a descriptive-survey design. This study constituted the quantitative phase of the sequential exploratory mixed-methods design of the broader research project. In this phase, the conceptual structure obtained from the qualitative phase—comprising seven dimensions, 22 components, and 72 indicators—served as the basis for designing the quantitative instrument and was subsequently tested and validated using inferential statistical methods. The statistical population included all 2,578 faculty members of universities and higher education institutions in Mazandaran Province. This population consisted of faculty members from 10 universities and higher education institutions in the province, including Islamic Azad University, Sari Branch (250 faculty members), National University of Skill (75), Mazandaran University of Medical Sciences (602), Babol University of Medical Sciences (297), Mazandaran Industrial Higher Education Institute, Babol (139), Mazandaran University of Science and Technology, Behshahr (40), Shomal University, Amol (70), Babol Noshirvani University of Technology (200), Islamic Azad University, Babol Branch (625), and Islamic Azad University, Qaemshahr Branch (280). Using Cochran's formula at a 95% confidence level and a 5% margin of error, the required sample size was estimated at 334 participants. Subsequently, proportionate stratified random sampling was employed to determine the sample size for each university based on its proportion in the statistical population, and participants were randomly selected from among the faculty members of each university (Table 1).

Table 1. Population and Sample Size by University

University	Population	Sample	Proportion (%)
Islamic Azad University, Sari Branch	250	32	9.7
National University of Skill	75	10	2.9
Mazandaran University of Medical Sciences	602	78	23.3
Babol University of Medical Sciences	297	39	11.5

Mazandaran Industrial Higher Education Institute, Babol	139	18	5.4
Mazandaran University of Science and Technology (Behshahr)	40	5	1.6
Shomal University (Amol)	70	9	2.7
Babol Noshirvani University of Technology	200	26	7.8
Islamic Azad University, Babol Branch	625	81	24.2
Islamic Azad University, Qaemshahr Branch	280	36	10.9
Total	2,578	334	100

The data collection instrument was a researcher-developed questionnaire consisting of 72 items rated on a five-point Likert scale, designed directly on the basis of the seven-dimensional conceptual model derived from the qualitative phase. The items were organized into 22 components under seven main dimensions, including 12 items for Entrepreneurial and Smart Competencies, 12 items for Artificial Intelligence and Data Competencies, 12 items for Smart Curriculum Design and Structure, eight items for Active and Applied Learning, 10 items for Human and Professional Competencies, 10 items for Infrastructure, Faculty, and Organizational Support Ecosystem, and eight items for Program Evaluation and Outcomes. The content and face validity of the instrument were confirmed by the expert panel involved in the qualitative phase.

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Findings and Results

Before conducting the inferential analyses, the internal reliability of the questionnaire and its seven dimensions was assessed using Cronbach's alpha coefficient (Table 2). The Cronbach's alpha coefficient was .949 for the overall instrument and ranged from .850 for Human and Professional Competencies to .961 for Infrastructure, Faculty, and Organizational Support Ecosystem. All coefficients were substantially above the acceptable threshold of .70, confirming the satisfactory reliability of the instrument for validating the proposed model.

Table 2 presents the descriptive statistics (mean and standard deviation) and the results of the one-sample *t* test for each of the seven dimensions of the model against the theoretical criterion mean of 3, representing the midpoint of the five-point scale.

Table 2. Descriptive Statistics, Reliability, and One-Sample t-Test Results for the Model Dimensions Against the Criterion Mean of 3 (N = 334)

Dimension	Mean	SD	Cronbach's α	*t*	*p*
Entrepreneurial and Smart Competencies	3.64	0.65	.934	17.90	< .001
Artificial Intelligence and Data Competencies	3.60	0.76	.905	14.47	< .001
Smart Curriculum Design and Structure	3.83	0.59	.859	25.97	< .001
Active and Applied Learning	3.49	0.80	.926	11.13	< .001
Human and Professional Competencies	3.74	0.65	.850	20.91	< .001
Infrastructure, Faculty, and Organizational Support Ecosystem	3.94	0.93	.961	18.51	< .001
Program Evaluation and Outcomes	3.73	0.74	.940	17.92	< .001
Overall model score	3.71	0.45	.949	28.59	< .001

As shown in Table 2, the mean scores of all seven dimensions were significantly higher than the theoretical criterion mean of 3 ($p < .001$ in all cases). The highest mean was observed for "Infrastructure, Faculty, and Organizational Support Ecosystem" (M = 3.94), followed by "Smart Curriculum Design and Structure" (M = 3.83), whereas the lowest mean—although still significantly above the criterion mean—was observed for "Active and Applied Learning" (M = 3.49). The overall model score (M = 3.71, SD = 0.45) was also significantly higher than the theoretical criterion mean, t = 28.59, $p < .001$, collectively providing strong empirical support for the content and empirical validity of the proposed seven-dimensional model from the perspective of faculty members at universities in Mazandaran Province. It is also noteworthy that the statistical effect sizes underlying these differences appear substantial. Given the large *t* statistics, ranging from approximately 11 to 29, together with the relatively large sample size (N = 334), it can be inferred that these statistically significant differences are not merely attributable to the large sample size but represent meaningful and substantive effects within the population of faculty members at universities in Mazandaran Province. In particular, the difference between the mean score for "Infrastructure, Faculty, and Organizational Support Ecosystem" (M = 3.94) and the criterion mean amounted to 0.94 points, representing the largest difference among all dimensions and indicating relatively stronger consensus among respondents regarding the importance of this dimension. To determine the relative priorities assigned by respondents to the seven dimensions, the nonparametric Friedman test was conducted. The results indicated a statistically significant difference among the rankings of the seven dimensions, $\chi^2 = 114.60$, $df = 6$, $p < .001$. Table 3 presents the mean rank for each dimension.

Table 3. Results of the Friedman Test for Prioritizing the Model Dimensions

Rank	Dimension	Mean Rank
1	Infrastructure, Faculty, and Organizational Support Ecosystem	3.22
2	Smart Curriculum Design and Structure	3.59
3	Program Evaluation and Outcomes	3.93
4	Human and Professional Competencies	4.01
5	Entrepreneurial and Smart Competencies	4.26
6	Artificial Intelligence and Data Competencies	4.17
7	Active and Applied Learning	4.82

According to Table 3, "Infrastructure, Faculty, and Organizational Support Ecosystem," with a mean rank of 3.22, received the highest priority among the seven dimensions. This finding indicates that faculty members regard the provision of technological infrastructure, faculty development, and university managerial support as fundamental prerequisites for the successful implementation of any entrepreneurship–artificial intelligence curriculum. In contrast, “Active and Applied Learning,” with a mean rank of 4.82, received the lowest relative priority. This finding may be interpreted to mean that although this dimension was still statistically and significantly endorsed, it was not regarded by faculty members as the foremost implementation priority relative to the other dimensions, possibly because the implementation of project-based learning itself depends on the prior availability of adequate infrastructure and faculty capabilities represented by the first dimension. To assess the fit of the proposed seven-dimensional factor structure to the collected data, confirmatory factor analysis was performed on the mean scores of the 22 components under the seven hypothesized latent factors. The model fit indices are presented in Table 4.

Table 4. Goodness-of-Fit Indices for the Confirmatory Factor Analysis of the Seven-Dimensional Structure

Fit Index	Obtained Value	Acceptable Criterion
Normed chi-square (χ^2/df)	10.30	< 3 desirable / < 5 acceptable
Comparative Fit Index (CFI)	.77	> .90
Tucker–Lewis Index (TLI)	.71	> .90
Root Mean Square Error of Approximation (RMSEA)	.17	< .08
Goodness-of-Fit Index (GFI)	.75	> .90

The results of the confirmatory factor analysis indicated that the absolute and comparative fit indices of the seven-factor model did not reach fully satisfactory levels and remained below conventional criteria for excellent model fit. Nevertheless, the overall direction of the component factor loadings on the hypothesized factors was positive and conceptually consistent with the qualitative structure of the model. This finding, together with the strong support obtained from the exploratory factor analysis reported in the first article of this research series (KMO = .871; explained variance = 69.1%), suggests that the seven-dimensional conceptual structure receives relative empirical support. However, achieving satisfactory fit in the confirmatory model requires further model refinement because of the relatively high complexity of the model, including the large number of parameters estimated relative to the sample size at the subcomponent level, as well as the natural correlations among several conceptually related dimensions, particularly the competency-oriented dimensions. Future studies should therefore consider reducing the number of freely estimated parameters or employing hierarchical or bifactor factor-analytic approaches. Nevertheless, the combined evidence obtained from three independent sources—the qualitative–quantitative convergence observed in the first phase, exploratory factor analysis, and the *t* and Friedman tests conducted in the present phase—collectively provides acceptable support for the construct validity as well as the content and empirical validity of the proposed seven-dimensional model.

It should be noted that an important methodological consideration must be taken into account when interpreting the confirmatory factor analysis fit indices. The 22 components, rather than the original 72 individual items, were used as indicators of the latent factors in this analysis. Although this approach—commonly referred to as “item parceling” or parceling—is frequently employed in complex models to reduce the parameter-to-sample-size ratio, it may cause some component-specific variance to be overlooked in the calculation of model fit indices. Accordingly, the reported fit indices should be interpreted as conservative estimates of the adequacy of the model’s factor structure rather than as definitive evidence for either complete rejection or complete confirmation of the proposed model. Combining these findings with the stronger evidence obtained from the exploratory factor analysis conducted at the level of the original questionnaire items provides a more comprehensive and balanced assessment of the construct validity of the model.

Discussion and Conclusion

The present study aimed to validate a proposed entrepreneurship-oriented curriculum model incorporating an artificial intelligence approach in universities of Mazandaran Province. The findings provided substantial empirical support for several aspects of the proposed seven-dimensional model. First, the instrument demonstrated high internal consistency, with a Cronbach's alpha of .949 for the total scale and coefficients ranging from .850 to .961 across the seven dimensions. Second, the mean scores of all seven dimensions were significantly higher than the theoretical criterion mean of 3, indicating that faculty members generally endorsed all dimensions as relevant and important components of the proposed model. Third, the Friedman test showed significant differences in the relative priorities assigned to the dimensions, with "Infrastructure, Faculty, and Organizational Support Ecosystem" ranked first, followed by "Smart Curriculum Design and Structure," whereas "Active and Applied Learning" received the lowest relative priority. Finally, the confirmatory factor analysis provided only partial support for the hypothesized seven-factor structure because the principal fit indices did not meet conventional thresholds for satisfactory model fit. Taken together, these findings suggest that the proposed model enjoys strong content-related and empirical endorsement from faculty members, although its latent structural configuration requires further refinement before it can be regarded as fully confirmed.

The significant endorsement of all seven dimensions indicates that faculty members perceive entrepreneurship-oriented curriculum development in the age of artificial intelligence as a multidimensional undertaking rather than as a narrow addition of entrepreneurship or technology courses to existing programs. This result is consistent with contemporary research emphasizing that entrepreneurship curricula must integrate multiple elements, including competencies, curriculum content, pedagogy, assessment, faculty capacity, institutional support, and connections with the entrepreneurial environment (1-3). It is also compatible with curriculum models that conceptualize entrepreneurship education as an interconnected system rather than a collection of isolated instructional components (7). The overall mean score of 3.71 suggests that respondents regarded the seven-dimensional framework as more than moderately relevant and that the conceptual model derived from the qualitative phase retained considerable validity when examined quantitatively. This qualitative–quantitative convergence strengthens the argument that entrepreneurship education in higher education should be embedded across curriculum design, instructional processes, competency development, and institutional structures rather than treated as an extracurricular or peripheral activity.

The high score obtained for "Entrepreneurial and Smart Competencies" supports the growing view that entrepreneurship education should develop opportunity recognition, creativity, initiative, adaptive thinking, problem-solving, and value creation alongside more conventional entrepreneurial knowledge. Recent work has emphasized entrepreneurial thinking as a foundational curricular orientation capable of preparing students to respond more effectively to uncertainty and rapidly changing socioeconomic environments (9). Similarly, research has shown that curriculum support can contribute to students' entrepreneurial intentions, especially when it is aligned with broader educational experiences and opportunities for entrepreneurial engagement (4). The current finding also aligns with evidence that curriculum, awareness of entrepreneurial risk, optimism, and opportunity perception jointly contribute to entrepreneurial intention (25). Thus, the endorsement of entrepreneurial and smart competencies indicates that faculty members recognize that future-oriented entrepreneurship curricula must cultivate not only business knowledge but also cognitive and behavioral capacities that enable learners to identify opportunities, make informed decisions, and act innovatively under conditions of uncertainty.

The significant endorsement of the "Artificial Intelligence and Data Competencies" dimension is equally important. AI is rapidly transforming curriculum development and higher education by altering how knowledge is produced, accessed, analyzed, personalized, and assessed (13). Therefore, the finding that faculty members rated AI and data competencies significantly above the criterion mean suggests an awareness that entrepreneurship graduates increasingly require familiarity with AI-enabled tools, data interpretation, digital decision-making, and intelligent systems. This result is compatible with studies showing that AI can support multiple stages of curriculum design, including needs assessment, learning personalization, content organization, assessment, and feedback (16, 17). It is also consistent with research indicating that AI learning and digital literacy can strengthen entrepreneurial behavior through mechanisms such as entrepreneurial self-efficacy (22). In entrepreneurial contexts increasingly shaped by platform economies, automation, data analytics, and intelligent technologies, the ability to use AI critically and strategically is becoming an integral component of entrepreneurial competence rather than an optional technical skill.

The relatively high mean and second-place ranking of "Smart Curriculum Design and Structure" further demonstrates that respondents regarded curriculum architecture as a central condition for successful integration of entrepreneurship and AI. This result is consistent with research arguing that AI requires curriculum adaptation at the structural level rather than the simple insertion of new technological content into existing courses (15). Curriculum adaptation in the AI era requires reconsideration of objectives, content sequencing, learning pathways, assessment procedures, interdisciplinary connections, and the relationship between human and machine-supported learning. The finding is also consistent with broader theoretical arguments that AI should be regarded not merely as an educational tool but as part of a changing educational and civilizational context that necessitates curriculum reconceptualization (14). Similarly, research synthesis in science education has demonstrated that meaningful AI integration depends on alignment among learning goals, content, technological resources, instructional approaches, and assessment (19). The strong endorsement of smart curriculum design in the present study therefore suggests that faculty members understand AI integration as a curriculum design problem rather than merely a technology adoption problem.

The highest priority assigned to "Infrastructure, Faculty, and Organizational Support Ecosystem" is one of the most consequential findings of the study. Although curriculum innovation often focuses on content and pedagogy, the respondents placed greatest importance on the technological, human, and organizational conditions necessary for implementation. This result strongly aligns with studies emphasizing that AI-based curricula require adequate technological infrastructure, faculty readiness, institutional support, governance mechanisms, and sustained professional development (18, 20). Without reliable technological infrastructure, access to AI tools, data resources, technical support, and appropriate institutional policies, even well-designed curricula may remain difficult to implement. Likewise, without faculty competence, AI-related educational innovations may be used superficially or inconsistently. The prominence of this dimension also accords with research highlighting lecturer competency as a key determinant of entrepreneurship education effectiveness (6). In this respect, the findings suggest that respondents view curriculum reform as inseparable from organizational capacity building.

The emphasis on faculty and organizational support also reflects the broader shift from traditional entrepreneurship education toward more ecosystem-oriented models. Entrepreneurship learning increasingly depends on interaction with external stakeholders, mentors, entrepreneurial organizations, technology providers, and real-world innovation environments. Practitioner-based research has shown that higher entrepreneurship education can be improved by strengthening connections between curricula and entrepreneurial practice, integrating authentic experiences, and involving external actors in teaching and learning (11). Emerging technologies may also reshape intermediary organizations and the structures through which entrepreneurship is facilitated (21). Therefore, the first-place ranking of infrastructure, faculty, and organizational support indicates that the success of entrepreneurship–AI curriculum reform depends not only on what is taught but also on whether the university can establish an enabling ecosystem for implementation.

The “Human and Professional Competencies” dimension was also significantly endorsed, indicating that faculty members do not view AI-based entrepreneurship education as primarily technological. This finding is important because effective entrepreneurship in AI-rich environments still depends on capacities such as communication, teamwork, ethical judgment, creativity, responsibility, adaptability, and critical thinking. Research on AI-supported curriculum development has repeatedly warned that curriculum transformation should not subordinate human educational goals to technological efficiency (14, 15). Similarly, research on personalized AI-based curricula suggests that personalization must remain aligned with meaningful educational objectives and learner development rather than becoming a purely algorithmic process (16). The present finding therefore supports a balanced model in which technological competence is complemented by human and professional capabilities that allow graduates to use AI responsibly, critically, and creatively.

The significant endorsement of “Program Evaluation and Outcomes” likewise confirms the importance of aligning assessment with the intended competencies of entrepreneurship and AI education. Entrepreneurship curricula are expected to generate complex outcomes extending beyond factual knowledge, including entrepreneurial intention, mindset, self-efficacy, innovation, opportunity recognition, and applied problem-solving. Prior studies have shown that entrepreneurship education and curriculum can influence entrepreneurial intention, although these effects may depend on individual and contextual factors such as mindset, support, and learning opportunities (4, 5). The current finding suggests that evaluation systems should therefore move beyond conventional examinations and assess multidimensional outcomes more directly. The endorsement of this dimension is also consistent with previous efforts to validate entrepreneurship curriculum models empirically rather than relying solely on conceptual or expert-based judgments (24). Effective curriculum evaluation is particularly important in AI-integrated settings because both intended and unintended consequences of technological adoption require monitoring.

The lowest relative priority assigned to “Active and Applied Learning” requires careful interpretation. Importantly, this dimension was still significantly above the criterion mean, indicating that respondents did not reject its importance. Rather, they considered it relatively less urgent than the other dimensions. This finding may reflect an implementation sequence rather than a judgment about intrinsic educational value. Active and applied learning methods such as project-based learning, problem-solving, simulation, interdisciplinary teamwork, entrepreneurial experimentation, and authentic task performance typically require adequate faculty competence, institutional flexibility, technological resources, and supportive infrastructure. Therefore, respondents may have perceived infrastructure and curriculum design as prerequisites that must be established before active learning can be implemented effectively. This interpretation is consistent with studies emphasizing experiential and active pedagogies in entrepreneurship education (6, 11). It also aligns with integrated entrepreneurship curriculum frameworks that emphasize problem-solving, interdisciplinarity, and experiential learning, including STEAM-oriented approaches (23).

The finding regarding active and applied learning may also be understood in relation to student diversity and curriculum responsiveness. Engagement with entrepreneurship education can vary according to learner characteristics and preferences, suggesting that a single pedagogical approach may not be equally effective for all students (12). In AI-supported environments, however, adaptive and personalized learning technologies may provide new possibilities for differentiating active learning experiences according to student readiness, interests, and learning pathways. This creates an important connection between the relatively lower-ranked active-learning dimension and the highly endorsed smart curriculum and AI dimensions. Rather than treating active learning as separate from AI, future curriculum development may benefit from integrating AI-supported simulations, intelligent feedback, adaptive project scaffolding, and data-informed learning activities into entrepreneurship education.

The CFA findings require a more cautious interpretation than the other results. The obtained values of χ^2/df = 10.30, CFI = .77, TLI = .71, RMSEA = .17, and GFI = .75 do not satisfy commonly accepted criteria for good model fit. Consequently, the seven-factor structure cannot be regarded as fully confirmed on the basis of the present CFA. However, this result does not necessarily negate the conceptual relevance of the seven dimensions. Instead, it indicates that the empirical relationships among the 22 components may be more complex than represented in the specified first-order seven-factor model. Conceptual overlap among entrepreneurship, human competencies, AI competencies, active learning, and curriculum design may generate substantial cross-factor relationships. This is theoretically plausible because modern entrepreneurship and AI curricula are increasingly interdisciplinary and interconnected (3, 13). The finding may therefore point toward the need for alternative structural representations, such as second-order, hierarchical, bifactor, or partially correlated models.

The partial CFA support should also be interpreted alongside the stronger exploratory and criterion-based evidence obtained in this research program. The previously reported exploratory factor analysis yielded a KMO value of .871 and explained 69.1% of the variance, suggesting that the underlying data structure is sufficiently coherent for multidimensional interpretation. At the same time, all seven dimensions were significantly endorsed in the present phase and the overall scale showed high reliability. The convergence of these findings suggests that the main issue concerns the precise structural specification of the relationships among dimensions rather than the substantive relevance of the dimensions themselves. This distinction is important in curriculum validation. A model may contain highly relevant and internally consistent domains while still requiring re-specification of the covariance structure among those domains. Similar complexity is evident in the broader literature, where entrepreneurship curriculum design is increasingly conceptualized as multidimensional, interconnected, and influenced by contextual, pedagogical, technological, and institutional factors (2, 10).

The results also reinforce the contextual character of curriculum validation. Iranian higher education possesses specific institutional structures, faculty roles, resource constraints, governance arrangements, and educational traditions that influence how entrepreneurship and AI-related curriculum reforms can be implemented. Previous Iranian research has highlighted the importance of contextually appropriate entrepreneurial teaching models and curriculum structures (7, 8). Similarly, recent Iranian studies on AI-related curriculum design have emphasized the need to account for infrastructure, curricular requirements, personalization, faculty readiness, and educational context (17, 18). The current study extends this literature by combining entrepreneurship and AI within a unified higher education curriculum model and subjecting that model to empirical validation among faculty members across multiple universities in Mazandaran Province.

Overall, the findings suggest that an entrepreneurship-oriented curriculum incorporating AI should be developed as an integrated system composed of entrepreneurial and smart competencies, AI and data competencies, intelligent curriculum design, active learning, human and professional competencies, institutional infrastructure and support, and evaluation and outcomes. This conclusion is consistent with the broader direction of recent scholarship, which increasingly emphasizes the interdependence of entrepreneurship education, digital transformation, learner-centered curriculum design, faculty competence, and institutional ecosystems (11, 13, 22). At the same time, the relatively weak confirmatory fit indicates that the proposed seven-dimensional architecture should be regarded as a promising but still developing model. Its substantive dimensions appear strongly supported, whereas its exact statistical configuration requires additional testing and refinement. Thus, the principal contribution of the present study lies not in claiming definitive structural confirmation but in providing an empirically informed foundation for the continued development of an AI-integrated entrepreneurship curriculum adapted to the context of higher education in Mazandaran Province.

The present study has several limitations that should be considered when interpreting its findings. First, the study was conducted exclusively among faculty members of universities and higher education institutions in Mazandaran Province;

therefore, the findings cannot automatically be generalized to all Iranian universities or to higher education systems in other national contexts. Second, the study relied on self-reported questionnaire data, which may be influenced by respondents' perceptions, expectations, or socially desirable responses. Third, although the sample size was adequate for the principal statistical analyses, the complexity of the proposed factor structure and the number of parameters estimated may have contributed to the relatively poor CFA fit. Fourth, the use of the 22 component scores rather than all 72 original items as indicators in the confirmatory analysis reduced model complexity but may also have obscured item-level variance and cross-loadings. Finally, the cross-sectional design provided evidence of perceived validity at a single point in time and did not examine whether implementation of the proposed curriculum would actually improve entrepreneurial competencies, AI literacy, entrepreneurial intention, academic outcomes, or post-graduation entrepreneurial behavior.

Future research should replicate the validation process with larger and more diverse samples drawn from universities in multiple Iranian provinces and from different types of higher education institutions. The model should also be tested separately across disciplinary fields to determine whether its dimensional structure is invariant across areas such as engineering, humanities, management, medical sciences, and basic sciences. Future studies are encouraged to conduct item-level CFA using larger samples and to compare alternative specifications, including second-order factor models, bifactor models, exploratory structural equation modeling, and models allowing theoretically defensible cross-loadings. Longitudinal and quasi-experimental studies could examine whether implementation of the curriculum leads to measurable changes in AI competence, entrepreneurial self-efficacy, opportunity recognition, innovation, entrepreneurial intention, and actual entrepreneurial behavior. Future research should also incorporate the perspectives of students, university administrators, curriculum specialists, entrepreneurs, technology-sector actors, and policymakers so that validation is not limited to faculty perceptions.

From a practical perspective, universities seeking to implement the proposed model should prioritize the creation of technological and organizational conditions before attempting large-scale curricular transformation. Investment is needed in reliable digital infrastructure, access to appropriate AI platforms and data resources, technical support, and policies governing ethical and responsible use of AI. Faculty development should be treated as a central implementation strategy and should include both technical AI literacy and pedagogical training in project-based, problem-based, interdisciplinary, and entrepreneurship-oriented teaching. Curriculum committees should redesign programs so that entrepreneurial and AI competencies are progressively developed across courses rather than concentrated in isolated modules. Partnerships with businesses, startups, incubators, accelerators, technology firms, and entrepreneurial support organizations should be strengthened to provide authentic learning experiences. Assessment systems should also be revised to evaluate applied problem-solving, innovation, teamwork, AI-supported decision-making, entrepreneurial initiative, and real-world project outcomes. Implementation should proceed incrementally through pilot programs, continuous feedback, and periodic curriculum evaluation so that the model can be refined in accordance with institutional capacity and emerging technological developments.

Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

1. Saputra YA, Hernawan AH, Dewi L. Entrepreneurship Curriculum in Higher Education. West Science Social and Humanities Studies. 2024;2(01):106-12. doi: 10.58812/wsshs.v2i01.577.
2. Elpisah E, Suarlin S, Latang L, Pada A. Indonesian Higher Education's Entrepreneurial Curriculum: A Literature Review. Journal of Education Culture and Society. 2024;15(2):815-33. doi: 10.15503/jecs2024.2.815.833.
3. Shao L, Miao Y, Ren S, Cai S, Fan F. Designing a Framework for Entrepreneurship Education in Chinese Higher Education. Humanities and Social Sciences Communications. 2024;11(1):1-12. doi: 10.1057/s41599-024-03024-2.
4. Kaur M, Chawla S. Does Curriculum Support and Extra-Curriculum Support Contribute to Students' Entrepreneurial Intentions? Innovations in Education and Teaching International. 2025;62(2):657-73. doi: 10.1080/14703297.2024.2325646.
5. Purwanti S, Handayani P, Kusdiyanti H. The Effect of Entrepreneurship Education and Curriculum on Student Entrepreneurial Intention Moderated by Student Entrepreneurial Mindset. Asian Journal of Agricultural Extension, Economics & Sociology. 2024;42(5):68-81. doi: 10.9734/ajaees/2024/v42i52415.
6. Iwu CG, editor Solving the Puzzle of Entrepreneurship Education: Comprehending Pedagogy, Entrepreneurship Curriculum, and Lecturer Competency2025.
7. Bavafa D, Dehghani M, Javadipour M, Mohammadkazemi R. Synthesizing an Entrepreneurship Curriculum Model in Educational Sciences Based on Akker's Spider Web. Modern Educational Thought. 2021;17(3).
8. Yarali K, Tajari T, Safari M. Designing an Entrepreneurial Teaching Model in Iranian Higher Education. Sociology of Education. 2022;10(1):83-92.
9. Khoshnoudi A, Emaminejad M, Mohammadi Naini M. Designing a Curriculum Based on Entrepreneurial Thinking. Management and Educational Perspective. 2025;7(2).
10. Brant J, Kilar W. From Entrepreneurship to Business & Management Education: A Fundamental Curriculum Shift or Tinkering at the Edges? Journal of Curriculum Studies. 2025:1-14. doi: 10.1080/00220272.2025.2460475.
11. Tiberius V, Weyland M. Enhancing Higher Entrepreneurship Education: Insights from Practitioners for Curriculum Improvement. The International Journal of Management Education. 2024;22(2):100981. doi: 10.1016/j.ijme.2024.100981.
12. Starbird SA, Martin JM, Kalbas-Schmidt TA. Curriculum Preferences and Engagement of Online Entrepreneurship Students: The Influence of Age and Gender. Technology, Knowledge and Learning. 2025:1-16. doi: 10.1007/s10758-025-09828-8.
13. Abbasi BN, Wu Y, Luo Z. Exploring the Impact of Artificial Intelligence on Curriculum Development in Global Higher Education Institutions. Education and Information Technologies. 2025;30(1):547-81. doi: 10.1007/s10639-024-13113-z.
14. Fathi F, Fathi Vajargah K, Jafari E, Vahidi Asl M. Rethinking Curriculum in the Age of Artificial Intelligence, from Educational Tool to Civilizational Context: A New Approach in the Multicontextualization Movement. Curriculum Studies. 2024;19(75).

15. Karataş F, Eriçok B, Tanrikulu L. Reshaping Curriculum Adaptation in the Age of Artificial Intelligence. British Educational Research Journal. 2025;51(1):154-80. doi: 10.1002/berj.4068.

16. Azmand S, Fayyaz Saberi S, Esmaeili F, Rezaei Z. Artificial Intelligence in Designing Personalized Curricula. Tehran: Ghasd; 2025.

17. Aliakbari Z, Pourkarimi J. The Role of Artificial Intelligence in Curriculum Design: A Meta-Synthesis Study. Research in Teacher Education Curriculum Studies. 2024;4(2).

18. Bidel M, Momeni Mahmoei H, Ajam A. Identifying the Requirements and Contexts for Applying Artificial Intelligence in the Science Curriculum: A Thematic Analysis. Technology and Knowledge Scholarship in Education. 2025;5(3).

19. Ghorbani S, Ghaderi M, Khosravi M, Pourmohammadbagher Esfahani L. Analyzing the Components of the Primary Science Curriculum with Artificial Intelligence: A Research Synthesis Approach. Applied Educational Leadership. 2025;6(3).

20. Bagherabadi G, Emamjomeh SM, Emadi SR, Essareh A, Shirmohammadi Z. A Research Synthesis of the Challenges and Opportunities of an Artificial Intelligence-Based Teacher Education Curriculum. Teaching Experiences. 2025;3(4).

21. Mohammadi Khiareh M, Shahmoradi B. The Role of Emerging Artificial Intelligence and Blockchain Technologies in Intermediary Organizations Facilitating Entrepreneurship Development. Science and Technology Policy. 2025;18(3).

22. Hajizadeh A, Hasani M, Shirbagi N. Artificial Intelligence Learning and Digital Literacy: A New Approach to Strengthening Students' Entrepreneurial Behavior with the Mediating Role of Entrepreneurial Self-Efficacy. Teaching Research. 2025;13(3).

23. Cheraghi Z, Ahmadi P, Samadi P. Designing an Entrepreneurship Curriculum Framework Based on an Integrated STEAM Approach: A Qualitative Study in Upper Primary Education. Curriculum Research. 2025;15(1).

24. Daneshimoghaddam S, Sabergarkani A. Validation of a Curriculum Model Based on Entrepreneurship Education in Upper Secondary Education. Education, Training and Sustainable Development. 2024;2(3):1-18.

25. Ardi Z, Yulastri A, Hidayat H, Ganefri G, Yuliana Y, Susanto P, et al. Enhancing Entrepreneurial Intention through Curriculum, Risk Awareness, Optimism and Opportunities. Journal of Social and Economic Development. 2025;27(1):352-71. doi: 10.1007/s40847-024-00339-3.