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A Delphi-Based Curriculum Framework for Sustainable Entrepreneurship Education to Support the Sustainable Development Goals (SDGs)

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ABSTRACT

Sustainable Entrepreneurship Education (SEE) is important for preparing future entrepreneurs to generate economic value while addressing environmental and social challenges. This study developed a Delphi-based curriculum framework for Indonesian higher education to support the Sustainable Development Goals (SDGs). Fifteen experts from education, sustainability, curriculum development, industry, and government participated in three iterative Delphi rounds. The findings identified a hierarchy of curriculum priorities. Core sustainability competencies, including sustainability literacy, ethical leadership, and circular economy knowledge, achieved 90% agreement, while pedagogical strategies and assessment methods reached 88% and 85%, respectively. Experiential learning and project-based learning also received strong support, whereas AI-driven learning and long-term industry collaboration remained below the 80% consensus threshold. The resulting framework distinguishes core curriculum components from context-dependent enhancements for SEE implementation.

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1. INTRODUCTION

Entrepreneurship is increasingly expected to generate not only economic value but also meaningful environmental and social benefits. This development has expanded the role of entrepreneurship education from preparing students to establish commercially viable businesses toward developing broader entrepreneurial competencies and responsible problem-solving capabilities in higher education (Nabi *et al.*, 2017; Torres-Sánchez *et al.*, 2024; Rosário and Raimundo, 2024). Sustainable Entrepreneurship Education (SEE) consequently represents an important educational approach for integrating economic viability, environmental responsibility, and social value within the entrepreneurial learning process (Henriksen *et al.*, 2024; Torres-Sánchez *et al.*, 2024; Rosário and Raimundo, 2024).

This orientation is closely connected with the Sustainable Development Goals (SDGs), as higher education can develop the knowledge, values, competencies, and problem-solving capabilities needed to address sustainability challenges (Henriksen *et al.*, 2024). SEE therefore extends entrepreneurship education beyond venture creation and financial performance toward broader SDG priorities (Torres-Sánchez *et al.*, 2024; Rosário and Raimundo, 2024). Sustainability has consequently become a core concern in entrepreneurship education, with Education for Sustainable Development emphasizing ethical business practices, circular economy models, and social impact (Sitaridis and Kitsios, 2024; Anubhav *et al.*, 2024; Tiberius and Weyland, 2024). Sustainability-focused learning can also strengthen students' understanding of environmental and social issues and support creative problem-solving (Pratama and Assidik, 2024). However, many entrepreneurship curricula, particularly in developing contexts such as Indonesia, still lack structured sustainability integration, highlighting the need for frameworks that balance sustainability principles with entrepreneurial innovation and financial viability (Outsios and Kittler, 2018).

The relationship between SEE and the SDGs extends across quality education, productive economic activity, innovation, responsible business practices, and multi-stakeholder collaboration (Etzkowitz and Leydesdorff, 2000; Lans *et al.*, 2014). Entrepreneurship education can therefore support the SDGs when sustainability is embedded within competencies, pedagogical practices, learning activities, and assessment mechanisms rather than treated as an additional topic. Effective SEE requires alignment among these elements to ensure that sustainability becomes an integral part of entrepreneurial thinking and decision-making (Lans *et al.*, 2014; Pache and Chowdhury, 2012).

This challenge is particularly relevant in Indonesian higher education, where entrepreneurship education is expanding alongside innovation, startup, and digital initiatives. However, integrating sustainability principles remains challenging due to differences in institutional capacity, digital infrastructure, faculty preparedness, and resource availability.

Various pedagogical approaches have been proposed to strengthen entrepreneurship education. Experiential and problem-oriented learning allow students to engage directly with entrepreneurial challenges and develop practical competencies through authentic learning experiences, reflection, and collaborative problem-solving (Bentz *et al.*, 2025; Klapper *et al.*, 2024; Lans *et al.*, 2014). Gamification can strengthen motivation and engagement by incorporating interactive learning mechanisms into entrepreneurship education (Soares *et al.*, 2024). Technology-enhanced learning can complement face-to-face entrepreneurship education by increasing flexibility and supporting diverse learning activities (Henriksen *et al.*, 2024; Zawacki-Richter *et al.*, 2019).

Technological developments have further expanded the range of pedagogical possibilities available to entrepreneurship education. Digital platforms and AI-assisted learning can support flexible, adaptive, and personalized learning while providing opportunities for simulation, experimentation, and reflective decision-making (Henriksen *et al.*, 2024; Klapper *et al.*, 2024; Zawacki-Richter *et al.*, 2019). Nevertheless, technological attractiveness does not necessarily indicate universal curriculum feasibility because implementation depends on infrastructure, faculty competencies, institutional resources, and student readiness.

Experiential and technology-supported approaches differ in both educational value and implementation requirements. Some can be integrated directly into existing courses, whereas resource-intensive approaches depend more heavily on institutional capacity, infrastructure, and external collaboration. SEE curricula should therefore distinguish core educational components from context-dependent enhancements. This distinction is essential when SEE is linked to the SDGs, because universities need a realistic framework for prioritizing competencies and learning strategies according to both educational importance and implementation feasibility.

Previous studies have examined sustainability competencies, experiential learning, problem-based learning, blended learning, gamification, digital entrepreneurship, and AI-assisted learning in entrepreneurship education (Lans *et al.*, 2014; Torres-Sánchez *et al.*, 2024; Rosário and Raimundo, 2024; Tiberius and Weyland, 2024). However, these approaches are commonly investigated as separate pedagogical innovations rather than as interconnected components of a coherent SEE curriculum. Consequently, existing studies provide substantial evidence regarding the value of individual approaches but offer limited guidance on how these components should be combined, prioritized, and aligned within an integrated curriculum.

A further research gap concerns the balance between pedagogical value and implementation feasibility. Educational innovations may offer substantial benefits but remain difficult to implement because of limitations in infrastructure, faculty capability, institutional resources, or external partnerships. A systematic prioritization process is therefore needed to distinguish core curriculum components from context-dependent enhancements. The Delphi method is suitable for addressing this gap because it enables expert judgments to be iteratively collected, evaluated, and refined toward consensus (Tiberius and Weyland, 2024). By incorporating perspectives from educators, sustainability specialists, curriculum designers, industry professionals, and policymakers, the method can align educational priorities with implementation realities. This study therefore develops a Delphi-based SEE curriculum framework for Indonesian higher education to support the SDGs. The framework integrates five dimensions: sustainability competencies, pedagogical strategies, curriculum integration, assessment, and institutional enablers. Its novelty lies in translating multi-stakeholder consensus into a tiered curriculum architecture that separates core components from context-dependent enhancements.

2. LITERATURE REVIEW

2.1. Sustainable Entrepreneurship Education and Sustainable Development

SEE extends conventional entrepreneurship education, which traditionally emphasizes entrepreneurial learning and venture-related competencies, by integrating economic viability with environmental responsibility and social value (Nabi *et al.*, 2017; Rosário and Raimundo,

2024). Its purpose is not only to develop entrepreneurial competencies but also to prepare students to design ventures that respond to sustainability challenges through ethical decision-making, innovation, and responsible business practices (Torres-Sánchez *et al.*, 2024; Rosário and Raimundo, 2024). This orientation is consistent with Education for Sustainable Development, which emphasizes the development of knowledge, competencies, values, and actions needed to address sustainability challenges. In higher education, SEE can support SDGs by strengthening sustainability literacy, responsible innovation, entrepreneurial problem-solving, and interdisciplinary learning (Henriksen *et al.*, 2024; Lans *et al.*, 2014). However, integrating sustainability into entrepreneurship education requires more than inserting sustainability topics into existing courses. Effective SEE requires alignment among learning competencies, pedagogical strategies, curriculum activities, assessment, and implementation support (Lans *et al.*, 2014; Pache and Chowdhury, 2012). This need is particularly relevant in Indonesia, where entrepreneurship education is developing but institutional capacity, digital readiness, and industry collaboration vary across universities.

2.2. Pedagogical Approaches for SEE

Experiential, problem-based, and project-oriented learning engage students with authentic entrepreneurial challenges and strengthen practical decision-making, reflection, collaboration, and problem-solving (Klapper *et al.*, 2024; Lans *et al.*, 2014). Technology-enhanced and blended approaches can complement these activities by increasing flexibility and expanding learning opportunities (Henriksen *et al.*, 2024; Zawacki-Richter *et al.*, 2019). Gamification can further increase motivation and participation by incorporating interactive elements, challenges, and simulation-based learning mechanisms, including applications specifically designed for sustainable entrepreneurship education (Melo and Soares, 2025; Soares *et al.*, 2024). Digital technologies and AI-assisted learning can expand educational opportunities through personalized feedback, adaptive support, and technology-enhanced learning environments (Henriksen *et al.*, 2024; Zawacki-Richter *et al.*, 2019). Nevertheless, their implementation can depend strongly on digital infrastructure, faculty competencies, institutional resources, and student readiness. These pedagogical approaches therefore differ not only in their educational contributions but also in their implementation requirements.

Table 1 summarizes the major pedagogical approaches relevant to SEE, their expected contributions, and the main considerations affecting their application in higher education. No single pedagogical approach is sufficient to address all dimensions of SEE. Experiential, problem-based, and project-based learning emphasize direct application and problem-solving, whereas blended, gamified, and AI-assisted approaches provide additional flexibility, engagement, and personalization. However, the latter approaches generally require greater technological and institutional readiness. This distinction supports the need to evaluate pedagogical approaches not only according to their educational value but also according to their feasibility within different higher-education contexts.

2.3. Curriculum Integration, Assessment, and Institutional Support

SEE should integrate sustainability principles into the structure of entrepreneurship learning rather than treat sustainability as an independent topic. Project-based learning, sustainability assessment, digital entrepreneurship activities, and real-world business challenges can provide opportunities for students to apply sustainability concepts within entrepreneurial decision-making. Assessment is also important because conventional measures of business feasibility may not capture environmental and social dimensions.

Impact-oriented business planning, real-world problem-solving assignments, and industry-linked projects can help evaluate whether students are able to combine entrepreneurial viability with sustainability considerations (Pache and Chowdhury, 2012). The effectiveness of SEE also depends on institutional capacity, particularly the availability of learning resources and mechanisms for collaboration with external stakeholders. University incubation, open innovation, and sustainability-oriented entrepreneurial ecosystems can provide important institutional support for entrepreneurial learning (Saidi *et al.*, 2024; Yaqzan *et al.*, 2025). Industry-academia collaboration may provide students with authentic entrepreneurial experiences, although maintaining long-term partnerships can require institutional commitment and aligned objectives.

Table 1. Pedagogical approaches relevant to SEE. The table was synthesized from the literature (Henriksen *et al.*, 2024; Klapper *et al.*, 2024; Lans *et al.*, 2014; Soares *et al.*, 2024; Zawacki-Richter *et al.*, 2019).

PEDAGOGICAL APPROACH	MAIN EDUCATIONAL CONTRIBUTION	POTENTIAL CONTRIBUTION TO SEE	MAIN IMPLEMENTATION CONSIDERATION
Experiential Learning	Practical application and reflection	Connects sustainability concepts with real entrepreneurial situations	Requires authentic projects and mentoring
Problem-Based Learning	Critical thinking and problem-solving	Encourages solutions to environmental and social business challenges	Requires carefully designed problems
Project-Based Learning	Application of knowledge through projects	Supports sustainability-oriented venture development	Requires time, supervision, and assessment criteria
Blended Learning	Flexibility and knowledge reinforcement	Combines digital content with applied classroom activities	Depends on digital access and faculty readiness
Gamification	Motivation and engagement	Makes sustainability challenges interactive	Requires appropriate instructional design
AI-Assisted Learning	Personalized and adaptive learning	Supports individualized entrepreneurial decision-making	Depends on infrastructure, access, and faculty competence

3. METHODOLOGY

3.1. Research Design and Expert Panel

This study employed the Delphi method to develop and prioritize curriculum components for SEE in Indonesian higher education. The method combined qualitative and quantitative assessment through successive rounds of expert evaluation to identify competencies, pedagogical strategies, curriculum integration approaches, and assessment mechanisms (Tiberius and Weyland, 2024). The Delphi panel consisted of 15 experts selected through purposive sampling to represent academic, sustainability, curriculum, industry, and policy perspectives. The composition of the expert panel is shown in **Table 2**. The multidisciplinary composition of the panel enabled the curriculum framework to incorporate educational, sustainability, implementation, industry, and policy perspectives, consistent with the multi-expert orientation commonly applied in Delphi-based curriculum development.

Table 2. Composition of the Delphi expert panel.

EXPERT CATEGORY	NUMBER OF EXPERTS	EXPERTISE
Entrepreneurship educators	4	Higher education and entrepreneurship curriculum development
Sustainability experts	3	Environmental, social, and economic sustainability
Curriculum designers	3	Pedagogical innovation and academic curriculum design
Industry professionals	3	Sustainable business and entrepreneurial practice
Government policymakers	2	Entrepreneurship and education policy development
Total	**15**	-

3.2. Delphi Procedure

The Delphi process comprised three iterative rounds, progressing from exploration to quantitative prioritization and final consensus, as summarized in **Figure 1**:

(i) Round 1 used open-ended questions to identify the competencies required by sustainable entrepreneurs, appropriate teaching strategies, and barriers and enablers affecting curriculum implementation. Responses were analyzed thematically to identify recurring themes, which were subsequently transformed into structured questionnaire items for Round 2.

(ii) Round 2 used a Likert-scale questionnaire to evaluate the importance and feasibility of the identified curriculum elements. The assessment covered three areas: pedagogical methods, curriculum integration, and evaluation strategies. The evaluated elements included experiential learning, gamification, AI-driven adaptive learning, project-based learning, sustainability assessment, digital entrepreneurship training, impact-driven business planning, industry collaboration, and real-world problem-solving.

(iii) Round 3 presented the summarized Round 2 findings to the experts for reassessment and refinement. Curriculum components reaching at least 80% agreement were classified as achieving consensus. Remaining differences were addressed through online focus group discussions before finalizing the curriculum framework.

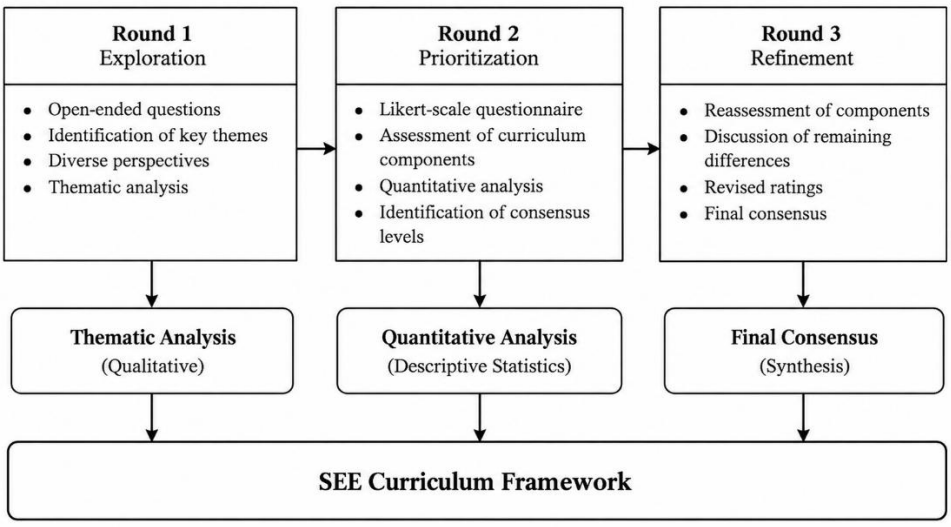

Figure 1. Delphi Process for developing the SEE curriculum framework.

3.3. Data Analysis

Qualitative and quantitative analyses were integrated across the Delphi rounds. Thematic analysis was used in Round 1 to identify recurring competencies, pedagogical strategies, curriculum approaches, and implementation considerations. In Rounds 2 and 3, descriptive statistics comprising the mean, standard deviation (SD), and percentage agreement were used to evaluate expert judgments and determine consensus, consistent with the quantitative consensus-building approach used in Delphi-based curriculum research (Tiberius and Weyland, 2024). The percentage agreement served as the primary criterion for final classification. Components reaching ≥80% agreement were considered consensus-based curriculum components, whereas components below this threshold were retained for further contextual consideration rather than classified as consensus components. This distinction provided the analytical basis for differentiating core curriculum priorities from context-dependent enhancements.

3.4. Ethical Considerations

Participation was voluntary and based on informed consent, and confidentiality was maintained throughout the Delphi process. Ethical procedures were applied with consideration of the Indonesian educational context and established research principles.

4. RESULTS AND DISCUSSION

The Delphi process progressively transformed broad expert opinions into prioritized curriculum components for SEE. Round 1 identified the principal competencies, pedagogical approaches, and implementation conditions; Round 2 quantified their importance and feasibility; and Round 3 refined these elements using the predetermined 80% consensus threshold. This sequential process enabled strongly supported curriculum components to be distinguished from those requiring greater institutional readiness or further development (Tiberius and Weyland, 2024).

4.1. Round 1: Identification of SEE Priorities

The first Delphi round generated three major themes: core competencies, pedagogical strategies, and implementation enablers. Experts emphasized critical thinking, ethical decision-making, and sustainability literacy as foundational competencies, while experiential learning, problem-based learning, and gamification were identified as relevant instructional approaches. Faculty development, institutional support, and industry collaboration emerged as important implementation conditions. As summarized in **Table 3**, SEE requires more than sustainability-related knowledge. The findings emphasize the integration of sustainability competencies, active learning, and institutional support, consistent with approaches connecting entrepreneurial knowledge with authentic problem-solving and responsible entrepreneurial action (Lans *et al.*, 2014).

4.2. Round 2: Prioritization of Curriculum Components

Round 2 evaluated expert judgments across three domains: pedagogical strategies, curriculum integration, and assessment strategies, as summarized in **Table 4**. Project-based learning showed the highest agreement (88%), followed by experiential learning (85%) and impact-driven business planning (84%), indicating a preference for application-centered approaches linked to authentic problems, practical experience, and sustainability-oriented

decision-making (Klapper *et al.*, 2024; Lans *et al.*, 2014). Gamification also exceeded the consensus threshold, supporting the role of interactive learning in strengthening engagement and motivation (Soares *et al.*, 2024). AI-driven adaptive learning, digital entrepreneurship training, and industry collaboration projects remained below 80%, suggesting greater dependence on infrastructure, faculty capability, resources, and institutional readiness.

Table 3. Key themes identified in Delphi round 1.

THEME	MAIN FINDINGS	MAIN CHALLENGE	SUGGESTED RESPONSE
Core competencies	Critical thinking; Ethical decision-making; Sustainability literacy	Lack of standardized competency structure	Develop an integrated SEE competency framework
Pedagogical strategies	Experiential learning; Problem-based learning; Gamification	Resistance to innovative teaching approaches	Faculty development and pedagogical support
Institutional enablers	Faculty training; Industry collaboration; Institutional support	Limited resources and funding	Strengthen institutional and external partnerships

Table 4. Expert evaluation of SEE curriculum components in Delphi Round 2.

DOMAIN	COMPONENT	MEAN	SD	AGREEMENT (%)	CONSENSUS STATUS
Pedagogical strategy	Experiential learning	4.6	0.5	85	Achieved
Pedagogical strategy	Gamification	4.4	0.6	82	Achieved
Pedagogical strategy	AI-driven adaptive learning	4.2	0.7	78	Not achieved
Curriculum integration	Project-based learning	4.5	0.5	88	Achieved
Curriculum integration	Sustainability assessment	4.3	0.6	80	Achieved
Curriculum integration	Digital entrepreneurship training	4.1	0.7	76	Not achieved
Assessment strategy	Impact-driven business planning	4.4	0.5	84	Achieved
Assessment strategy	Industry collaboration projects	4.2	0.6	79	Not achieved
Assessment strategy	Real-world problem-solving assignments	4.3	0.6	81	Achieved

Figure 2(a) shows that experiential learning and gamification achieved consensus, whereas AI-driven adaptive learning remained below the 80% threshold. **Figure 2(b)** indicates that project-based learning received the strongest support for curriculum integration, followed by sustainability assessment, while digital entrepreneurship training remained below the consensus threshold. **Figure 2(c)** shows that impact-driven business planning and real-world problem-solving assignments achieved consensus, whereas industry collaboration projects fell slightly below the threshold. Overall, these findings demonstrate a consistent preference for application-centered learning over technology- or partnership-intensive approaches, supporting the use of experiential, project-based, and impact-oriented activities as central components of SEE while positioning more resource-dependent approaches according to institutional readiness.

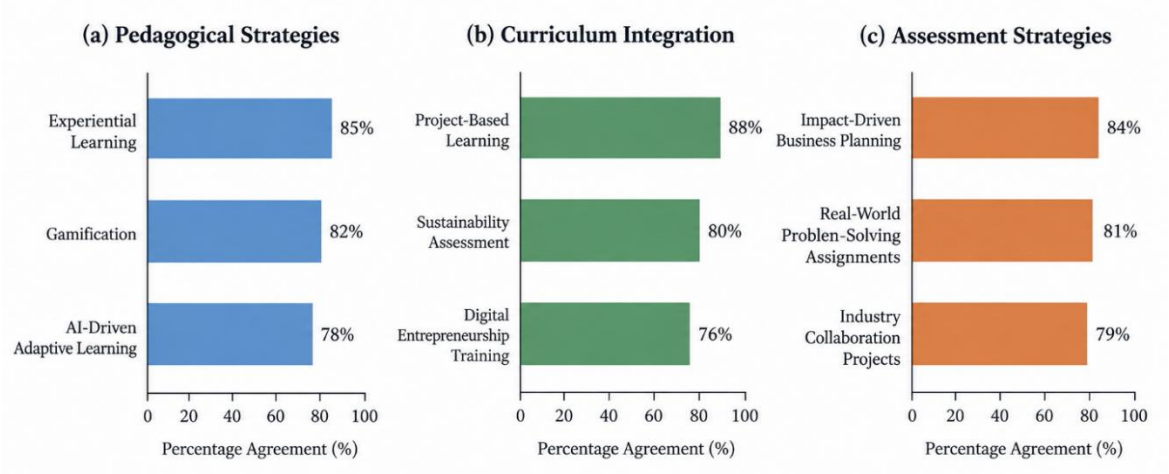

Figure 2. Comparative prioritization of SEE curriculum components in Delphi Round 2. (a) Pedagogical strategies; (b) Curriculum integration; and (c) Assessment strategies. The consensus threshold was set at 80%.

4.3. Round 3: Final Consensus and Curriculum Classification

Round 3 reassessed the curriculum priorities through expert discussion, while the overall Delphi results were subsequently synthesized into core components and context-dependent enhancements. Core competencies, pedagogical strategies, and assessment methods exceeded the predetermined consensus threshold, whereas AI-driven learning and long-term industry collaboration remained slightly below 80%.

Table 5 reveals that the curriculum components do not have equal levels of expert support. Components exceeding the threshold can form the common foundation of SEE, whereas those below the threshold require greater contextual consideration before implementation. Digital entrepreneurship training, which remained below the consensus threshold in Round 2 (76%), was retained as a context-dependent enhancement in the final framework. AI-driven learning illustrates this distinction. Although experts recognized its potential, concerns regarding accessibility, scalability, faculty preparedness, and technological infrastructure limited consensus. AI-supported education can provide adaptive and personalized learning opportunities, but meaningful implementation requires attention to educators, institutional capacity, and pedagogical design (Henriksen *et al.*, 2024; Zawacki-Richter *et al.*, 2019). Industry collaboration showed a similar pattern. Its educational value was recognized, but long-term implementation may be affected by funding, continuity, institutional commitment, and alignment between academic and industry objectives. University-industry collaboration can strengthen entrepreneurial learning, although sustainable partnerships require appropriate institutional mechanisms and shared objectives (Etzkowitz and Leydesdorff, 2000).

Table 5. Final Delphi Consensus and Classification of SEE Components

CURRICULUM DIMENSION	AGREEMENT (%)	CONSENSUS STATUS	FRAMEWORK POSITION
Core Competencies	90	Achieved	Core Component
Pedagogical Strategies	88	Achieved	Core Component
Assessment Methods	85	Achieved	Core Component
Industry Collaboration	79	Not achieved	Context-Dependent Enhancement
AI-Driven Learning	78	Not achieved	Context-Dependent Enhancement

Figure 3(a) presents the curriculum components that achieved the predetermined consensus threshold and were therefore classified as core components of SEE. **Figure 3(b)** shows components that remained below the 80% threshold and were consequently classified as context-dependent enhancements. This distinction provides a practical hierarchy for curriculum implementation by separating broadly supported components from those whose adoption may depend on institutional readiness, resources, and implementation context.

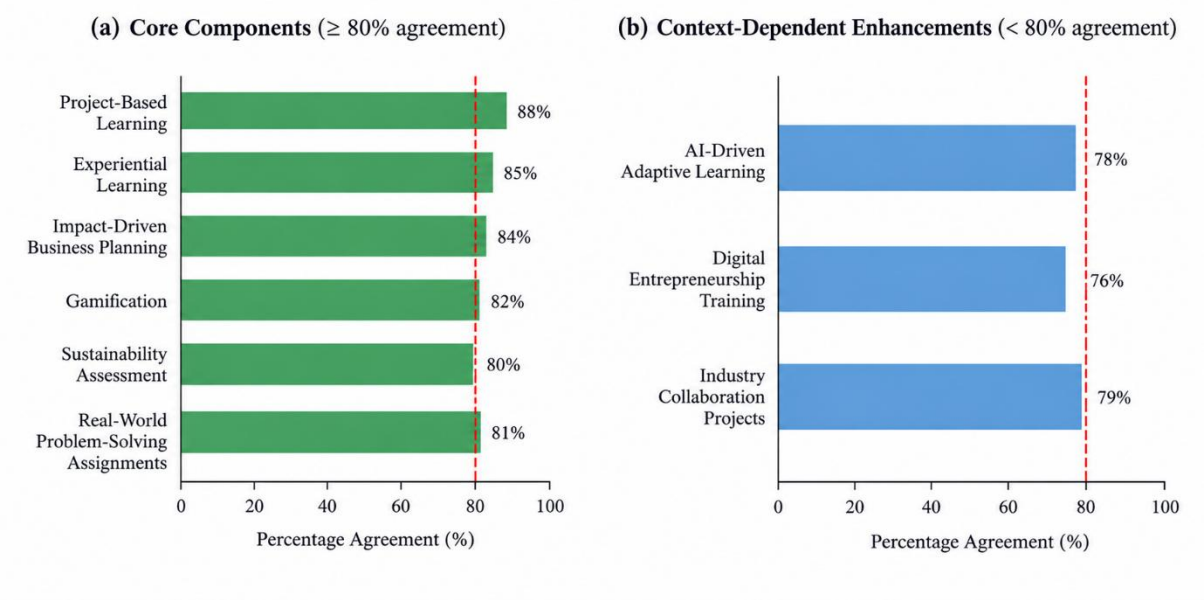

Figure 3. Consensus-based classification of SEE curriculum components: (a) core components achieving ≥80% agreement and (b) context-dependent enhancements receiving <80% agreement.

4.4. Delphi-Based SEE Curriculum Framework

The three Delphi rounds were integrated into a tiered SEE curriculum framework, as presented in Figure 4. The framework connects sustainability competencies with pedagogical strategies, curriculum integration, assessment, and sustainable entrepreneurial outcomes, while institutional conditions influence the adoption of context-dependent enhancements.

Figure 4 positions sustainability competencies as the educational foundation of SEE. Experiential and problem-oriented pedagogies translate these competencies into learning experiences, while sustainability-oriented assessment evaluates students' ability to integrate entrepreneurial viability with environmental and social considerations. This structure is consistent with competency-based approaches emphasizing knowledge, action, reflection, and responsible decision-making in SEE (Lans *et al.*, 2014; Pache and Chowdhury, 2012). The framework does not exclude digital technologies or industry collaboration. Instead, these elements are positioned as enhancements whose adoption depends on institutional readiness. This distinction increases the applicability of the framework across higher education institutions with different technological, financial, and organizational capacities.

4.5. Contribution of the SEE Framework to the SDGs

The proposed framework can support several SDGs through its educational objectives and implementation mechanisms. **Table 6** maps the SEE components to relevant SDGs based on their expected educational contributions. These relationships indicate alignment and potential contribution rather than direct achievement of individual SDG targets. The most

direct alignment is with SDG 4 through the development of sustainability-oriented knowledge and competencies in higher education. The framework may also support SDGs 8, 9, 12, and 17 through responsible entrepreneurship, innovation, sustainable business practices, and multi-stakeholder collaboration; these relationships should be interpreted as conceptual alignment rather than direct evidence of SDG achievement (Etzkowitz and Leydesdorff, 2000; Henriksen *et al.*, 2024; Lans *et al.*, 2014).

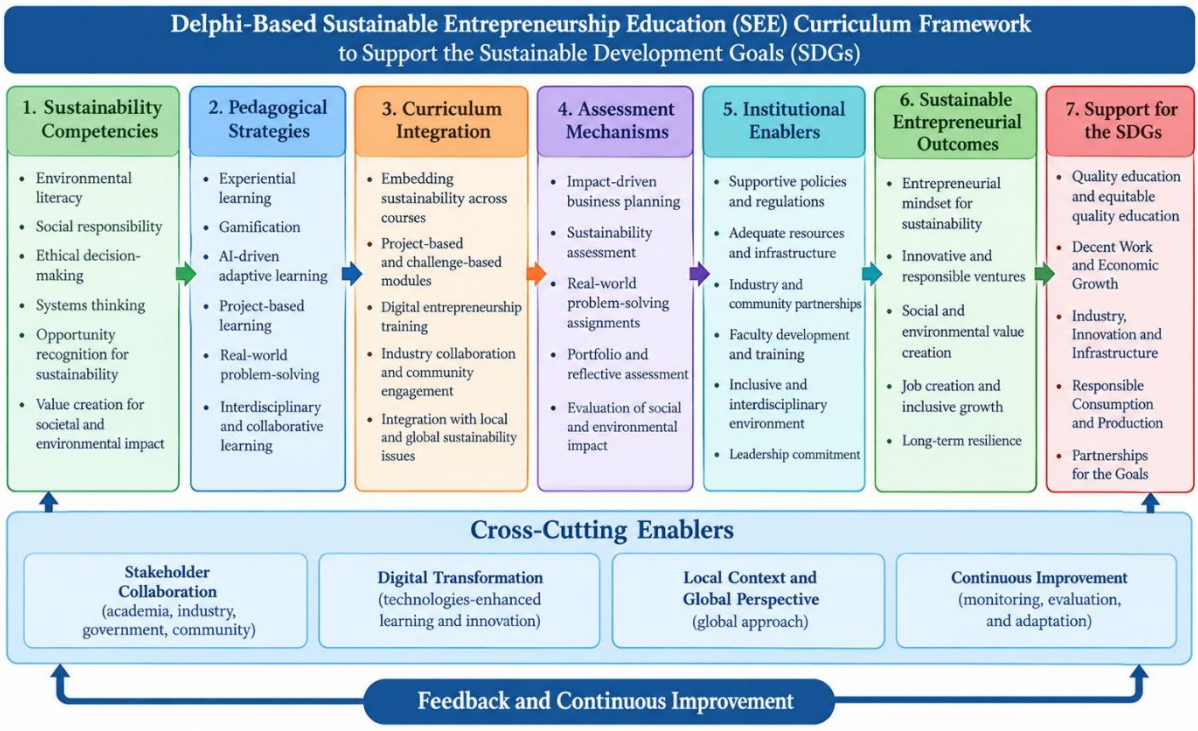

Figure 4. Delphi-based curriculum framework for SEE to support the SDGs.

Table 6. Alignment of the SEE curriculum framework with the SDGs.

SEE COMPONENT	EXPECTED EDUCATIONAL CONTRIBUTION	RELEVANT SDG
Sustainability literacy	Develops understanding of SDG challenges	SDG 4 - Quality education
Ethical leadership	Strengthens responsible entrepreneurial decision-making	SDG 8 - Decent work and economic growth
Circular economy knowledge	Encourages resource-conscious and responsible business models	SDG 12 - Responsible consumption and production
Project- and problem-based learning	Develops sustainability-oriented innovation and problem-solving	SDG 9 - Industry, innovation and infrastructure
Stakeholder collaboration	Promotes knowledge exchange and collaborative learning	SDG 17 - Partnerships for the goals

Figure 5 illustrates how SEE can support SDGs through an educational pathway rather than through direct SDG achievement. The framework begins with sustainability competencies and translates them into entrepreneurial learning, practical action, and impact-oriented assessment before contributing to broader SDG priorities.

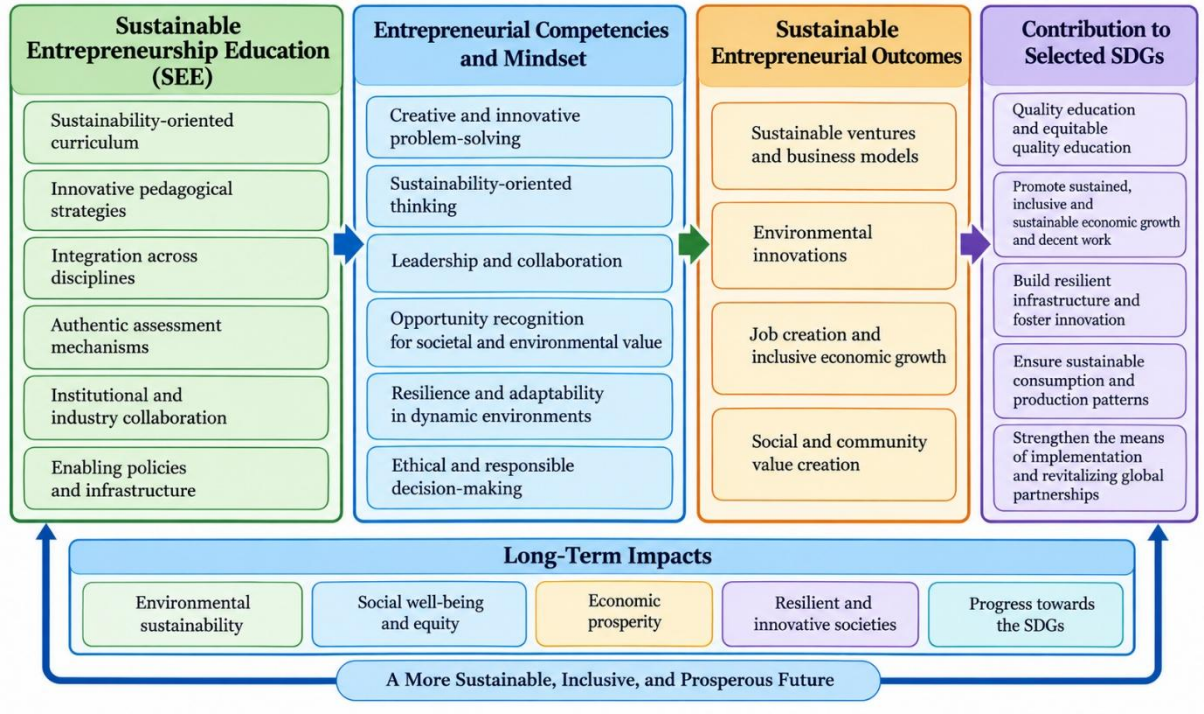

Figure 5. Pathway from SEE to the SDGs.

4.6. Implications for Curriculum Implementation

Universities should prioritize components with strong expert consensus rather than simultaneously adopting all available educational innovations. Sustainability competencies, experiential and problem-oriented learning, and impact-based assessment can provide the common foundation, while AI-assisted learning, advanced digital approaches, and long-term industry collaboration can be introduced according to institutional readiness. Faculty capability remains important because SEE requires educators who can facilitate experiential learning, sustainability-oriented projects, and interdisciplinary problem-solving. Faculty development and adequate learning resources therefore represent important conditions for effective curriculum implementation, while incubation and external innovation networks can strengthen students' access to entrepreneurial practice (Saidi *et al.*, 2024; Pache and Chowdhury, 2012). The framework also allows institutional adaptation. Universities with stronger digital infrastructure and external networks can integrate AI-assisted learning and extensive industry collaboration, whereas institutions with fewer resources can prioritize locally relevant experiential and project-based learning. This flexibility allows SEE to support SDGs without imposing a uniform implementation model across higher education institutions.

5. CONCLUSION

This study developed a Delphi-based curriculum framework for SEE in Indonesian higher education to support the SDGs. The three-round Delphi process identified sustainability competencies, application-centered pedagogies, curriculum integration, and impact-oriented assessment as central elements of SEE. Importantly, the findings distinguish core curriculum components from context-dependent enhancements based on the 80% consensus threshold. AI-driven learning, digital entrepreneurship training, and industry collaboration showed potential but require appropriate institutional readiness. The framework therefore provides a flexible approach for integrating sustainability into entrepreneurship education while

considering differences in faculty capability, infrastructure, resources, and partnerships. SEE can support responsible entrepreneurship and contribute to the SDGs.

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7. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper is free from plagiarism.

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