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Cultivating Green Collar Entrepreneurs: The Influence of Economic and Environmental Knowledge on University Students' Entrepreneurial Intentions in the Field of Renewable Energy Sources—The Moderating Role of Self-Efficacy

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Abstract

This article analyzes how entrepreneurship education contributes to the development of economic awareness, supports innovation, and promotes the principles of sustainable development. The competencies acquired through this approach can lead to increased interest in renewable energy sources (RES) as both an economically viable and environmentally friendly solution. The research was empirical in nature and included both quantitative and qualitative components. In-depth interviews and surveys were used to identify factors that facilitate or hinder the integration of RES-related issues with entrepreneurship education. The main research goal of the article was to understand how entrepreneurship education influences the perception of renewable energy sources as an attractive and profitable investment and how it can support the development of social entrepreneurship and innovation in the renewable energy sector. The authors conducted an extensive literature review to identify research gaps in existing analyses. A lack of comprehensive empirical studies was identified that would comprehensively demonstrate how entrepreneurship education shapes attitudes and behaviors that foster interest in and implementation of RES technologies. Based on the obtained results, recommendations for educational systems were formulated, indicating the need to incorporate elements of entrepreneurial education into the process of shaping economic and social awareness. This approach can significantly contribute to increasing interest in renewable energy sources and thus strengthening the concept of sustainable development.

Keywords: renewable energy sources; entrepreneurship; sustainable development; in-novation; competencies

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1. Introduction

The modern world faces unprecedented challenges related to climate change, growing energy demand, and the need to transition to sustainable development models. It is increasingly recognized that energy transformation is not merely a technological issue, but

also a social and educational one [1–3]. It requires new competencies—combining economic knowledge, innovation, and environmental awareness. In this context, entrepreneurship education is gaining particular importance, becoming a tool that enables individuals and communities to respond to dynamic economic processes while simultaneously supporting the implementation of environmentally friendly solutions.

Entrepreneurship education, traditionally associated with preparing for business activity, is evolving toward a broader understanding of entrepreneurship as a life approach, encompassing the ability to recognize and capitalize on opportunities in conditions of uncertainty [4–6]. Contemporary educational programs place increasing emphasis on developing so-called competencies of the future—creativity, strategic thinking, risk management, and teamwork. However, it is increasingly emphasized that business knowledge alone is not sufficient to meet the challenges of sustainable development [7–11]. Entrepreneurship education needs to be integrated with environmental and energy topics so that the educational process prepares students not only to generate profits but also to create innovations with social and ecological value [11–15].

Despite the growing importance of this issue, research findings on the impact of entrepreneurship education on sustainable development remain ambiguous. The literature indicates that although entrepreneurship education fosters the development of analytical and creative skills, its translation into concrete actions in the field of renewable energy sources (RES) is still limited [11]. Empirical evidence on how educational content and methods translate into actual pro-environmental decisions by students is lacking, especially in the context of willingness to invest in energy technologies based on sustainable solutions.

Existing research often focuses on general entrepreneurial attitudes, omitting the specifics of the green energy sector [16]. As a result, little is known about the psychological and educational mechanisms that may mediate the relationship between entrepreneurship education and behaviors that support sustainable development. Two factors are particularly important here: self-efficacy, which determines an individual's ability to make decisions under uncertainty, and risk perception, which influences willingness to invest in innovative, often costly renewable energy technologies.

This study attempts to combine both these dimensions—educational and psychological—to understand how entrepreneurship education can effectively contribute to promoting pro-environmental behaviors and supporting energy transition. The study includes both quantitative analyses (including logistic regression and SEM analysis) and qualitative analyses (interviews with representatives of renewable energy startups and lecturers teaching entrepreneurship courses), allowing for a multidimensional diagnosis of the relationship between education and sustainable development.

The main objective of the study is to assess the impact of entrepreneurship education on the development of pro-innovation and pro-environmental attitudes among students, taking into account the psychological and didactic mechanisms that foster the integration of renewable energy sources into decision-making and educational processes.

Based on this, the research hypothesis (H1) was formulated:

H1. *Entrepreneurship education supports the development of pro-environmental innovations and a positive attitude towards investing in renewable energy sources by developing analytical, strategic, and social competencies that reduce perceived risk and strengthen trust and commitment to sustainable energy projects.*

2. Literature Review

Interest in the links between entrepreneurship education and sustainable development has grown in recent years in response to global energy and environmental challenges.

The scientific literature increasingly emphasizes that entrepreneurship education can be an effective tool for supporting pro-ecological innovations [17–20], yet a unified model explaining the mechanisms behind this impact remains lacking.

Research from the early 2010s focused primarily on analyzing students' entrepreneurial intentions, without directly addressing the topic of renewable energy sources. In their systematic review of the literature from 2009–2019, Mohamed and Sheikh Ali noted that studies based on the theory of planned behavior and social learning predominated, with the context of sustainable development appearing only marginally [21]. Similar conclusions were reached by a bibliometric review by Bendig, Brüss, and Degen, which showed that research on entrepreneurship in the green energy sector focuses on the adaptation of existing economic structures, rarely considering their transformation [16].

One of the first areas where attempts were made to combine entrepreneurship education with energy topics were online courses [22,23]. A significant addition was made by the research of Beltrán Hernández de Galindo and co-authors, who, analyzing MOOCs on sustainable energy, found that only 14.3% of participants saw the topic as an opportunity to create a business venture. This result confirms the limited ability of traditional forms of education to stimulate entrepreneurship in the energy sector [24].

A growing number of studies are embracing the concept of sustainable entrepreneurship, which combines economic and ecological perspectives, viewing entrepreneurship as a process of creating not only financial but also social and environmental value [7–9]. Authors such as Eitan and colleagues point out that entrepreneurs in the renewable energy sector differ significantly in terms of motivation, resources, and risk tolerance, which requires flexible and diverse forms of education [25]. Haldar, in turn, emphasizes the importance of the institutional context—local regulatory and infrastructural barriers can significantly limit the effectiveness of educational and investment activities [26].

Recent research has increasingly emphasized that entrepreneurship education should be understood as a social process in which the development of business competencies goes hand in hand with the development of attitudes of responsibility and cooperation. Edokpolor and Somorin [27,28] point out that entrepreneurship education develops communication, problem-solving, and creativity skills—crucial for creating pro-ecological innovations [29–37]. Research, however, shows that the use of digital tools and artificial intelligence can support the individualization of the learning process, facilitating students in creating real-world projects in the green energy sector [15,38–45].

At the same time, a meta-analysis by Martin, McNally, and Kay demonstrates that educational interventions—both formal and practical—significantly strengthen entrepreneurial intentions, although these effects are strongly dependent on the quality of the program and the experience of participants [46]. For students without prior exposure to entrepreneurship, education can serve as an initiation, increasing self-confidence and readiness to undertake activities in new areas, such as renewable energy sources [47–49].

A common conclusion from the literature is that entrepreneurship education can be a catalyst for the development of green innovations, provided it is conducted holistically—combining economic, technical, and social aspects. However, there is still a lack of empirical research that quantitatively and qualitatively demonstrates how entrepreneurship education influences investment decisions and willingness to undertake activities in the field of renewable energy. This study attempts to fill this gap by combining educational, psychological, and energy perspectives within a coherent analytical framework that allows us to understand how entrepreneurship education can support the process of sustainable economic transformation.

Despite numerous theoretical premises and a growing number of empirical studies demonstrating the potential of entrepreneurship education in promoting innovation and

pro-environmental behavior, there are three fundamental gaps in the existing literature that justify the need for research combining an educational perspective with measurable outcomes in the field of renewable energy sources. First, many studies are sector-agnostic and analyze entrepreneurship education at a general level, which limits the ability to draw conclusions about its effectiveness in the context of the specific challenges and barriers characteristic of the energy sector. Mohamed and Sheikh Ali, as well as bibliometric reviews, demonstrate a clear dominance of analyses based on general theories (theory of planned behavior, social learning), while simultaneously marginalizing renewable energy sources (RES), leading to a cognitive gap in relation to the green energy sector. Second, although several reviews and studies document the barriers and opportunities for combining entrepreneurship with energy, these studies are often limited to descriptive analyses of online programs or courses and do not provide a systematic empirical explanation of the mechanisms through which education influences specific investment or implementation decisions [7,50,51]. For example, an analysis of MOOCs reveals a low percentage of participants perceiving real business opportunities in OER [24] but does not explain whether the reason is the course design, lack of practical elements, or contextual constraints.

Third, the literature lacks research integrating quantitative and qualitative approaches to identify intermediary psychological and educational mechanisms—such as self-efficacy, risk perception, or trust in technology—that could explain how acquired competencies translate into intentions and actual pro-environmental actions. Although studies in the area of sustainable entrepreneurship provide a theoretical framework [52,53], empirical evidence that entrepreneurship education enhances self-efficacy and reduces perceived risk is fragmented. There are also no studies showing that this leads to increased investment in renewable energy sources. Meta-analyses, however, confirm that educational programs improve competencies [54–61] but do not specify which educational components (e.g., ESG modules, practical cases, industry partnerships) are crucial for shaping behaviors in the energy context.

Additionally, there is insufficient attention paid to the heterogeneity of actors in the renewable energy ecosystem (startups, social entrepreneurship, energy cooperatives, and large corporate entities) who require different competencies and educational support. Therefore, there is a lack of research that considers these differences and examines how different configurations of EP programs (e.g., with an ESG component, industry mentoring, microgrants) impact specific types of actors and what environmental and social outcomes (measured, for example, by CO_2-eq reduction, the number of households covered by the solution, or the scalability of business models) are achieved as a result. Finally, there is a lack of studies using quasi-experimental approaches (e.g., DiD) or causal models, which would better distinguish correlations from causal effects of educational interventions. In summary, the current state of knowledge indicates significant potential for entrepreneurship education as a tool supporting energy transition, but empirical evidence remains fragmented due to (1) a lack of sector-specific studies on renewable energy sources (RES), (2) insufficient understanding of the mechanisms mediating between education and investment decisions, and (3) insufficient use of mixed methods and quasi-experimental analyses that could confirm the cross-sectional validity and generalizability of findings. This identified gap underscores the need for research combining quantitative and qualitative analyses that simultaneously measure educational interventions, psychological mechanisms, and real-world environmental and social outcomes in the renewable energy sector.

This study addresses this gap by employing a mixed-methods design that combines computer-based questionnaires and analyses of the RES-EP Readiness Index, structural equation modeling, and logistic regressions with semi-structured interviews and syllabus audits. In this way, the study not only tests the direct impact of entrepreneurship education

on renewable energy intentions and behaviors, but also identifies and verifies mediating mechanisms (self-efficacy, risk perception) and assesses the contextual determinants of program effectiveness (e.g., access to mentors, ESG modules, industry partnerships). This approach allows for both generalization of quantitative results and in-depth interpretation of mechanisms using qualitative data, which adds value to the existing literature.

3. Materials and Methods

This study is based on an approach that combines the analysis of scientific literature with empirical research. This approach allows not only to identify the main directions and findings of previous research but also to confront them with the opinions and experiences of entrepreneurship education participants and practitioners involved in the renewable energy sources (RES) sector.

The theoretical section was based on a systematic literature review in the Scopus, Web of Science, and ScienceDirect databases. The selection criteria were: (1) publication in peer-reviewed journals, (2) availability of a DOI number, and (3) topic related to entrepreneurship education, RES, or sustainable development. Publications from the years 2009–2025 were included. Content analysis enabled the categorization of sources into four main areas corresponding to the study's objectives:

- Perception of renewable energy as an investment;
- Development of entrepreneurial skills and attitudes;
- Social entrepreneurship and innovation in the renewable energy sector;
- Barriers and opportunities for integrating renewable energy topics into entrepreneurship education.

To deepen the analysis, empirical research was conducted in two stages: a survey and a qualitative one.

The survey was conducted using a questionnaire. The questionnaire was administered to students of economics, engineering, and natural sciences in Poland who were participating in courses related to entrepreneurship. The research sample consisted of 400 respondents, selected using purposive sampling. The study covered 400 students from Polish universities.

The questionnaire consisted of five main constructs measured on a 5-point Likert scale:

- Entrepreneurship Education (EP)—level of participation and self-assessment of acquired competencies.
- Economic Literacy—ability to assess the costs and benefits of investing in renewable energy sources.
- Perceived Economic Benefits—expected reduction in bills, long-term profitability.
- Trust in renewable energy sources—belief in the reliability and stability of the technology.
- Purchase Intention—willingness to invest in renewable energy sources within the next three years.

The questions were both closed-ended (using a Likert scale) and open-ended, allowing for the collection of quantitative and qualitative data. In the second stage, 18 semi-structured interviews were conducted with representatives of renewable energy startups and industry experts. Additionally, a questionnaire survey was conducted with 45 lecturers who taught entrepreneurship. The interviews and questionnaire surveys aimed to identify factors that facilitate or hinder the integration of renewable energy into entrepreneurship education, as well as to capture a practical perspective unavailable through analysis of academic texts alone.

The main areas of the interview questions concerned:

- Perception of the role of entrepreneurship education;

- University-industry connections;
- Innovation and social entrepreneurship in the context of sustainable development;
- Industry challenges and needs.

The areas of the questionnaire survey concerned:

- Integration of renewable energy sources (RES) into curricula;
- Teaching competencies and support available to business lecturers;
- Educational infrastructure and tools;
- Collaboration with the external sector;
- Assessment of barriers and needs.

The collected survey data were statistically analyzed using IBM SPSS Statistics 29.0. Descriptive statistics, correlation analysis, and tests for differences between groups (e.g., ANOVA) were used, allowing for the assessment of the relationship between perceptions of renewable energy sources and the level of developed entrepreneurial competencies.

Instead of conducting multiple t-tests for each pair of groups, a single ANOVA test allows for a simultaneous comparison of all groups, reducing the risk of a Type I error (false positive result). This technique can analyze multiple groups and variables simultaneously, making it a flexible tool for analyzing complex research problems. It also extends to repeated measures analyses and mixed models. With two-way ANOVA (or more advanced models), interactions between independent variables can be examined, providing deeper insight into how these factors collectively influence the dependent variable [62–75].

In the context of socio-economic research, such as analyzing the impact of entrepreneurship education on interest in renewable energy sources, the interpretation of statistical tests requires considering not only their numerical results but also their theoretical and practical significance. *p*-values, *t*-values, and β coefficients cannot be analyzed in isolation from the broader context of the study, as their interpretation depends on the adopted model, sample size, and theoretical assumptions. Methodological literature [76,77] emphasizes that the correct interpretation of results should encompass both statistical significance and the effect size, as well as the consistency of the observed relationships with theory and previous research results.

For this reason, contemporary researchers increasingly use a multivariate approach, combining significance analysis (*p*-value) with an assessment of the strength of the effect (e.g., β, Cohen's d, R^2) and the direction of the relationship. This perspective allows us to determine not only whether a relationship between variables exists, but also whether it is practically significant and consistent with theoretical expectations. In research on entrepreneurship education and sustainable development, it is particularly important to analyze the extent to which observed relationships translate into actual behavior—for example, whether entrepreneurship education actually increases willingness to invest in renewable energy technologies or only declaratively influences participants' attitudes [78–88].

Qualitative responses from open-ended questions and in-depth interviews were subjected to thematic analysis, enabling the identification of key barriers, opportunities, and recommendations for integrating entrepreneurship and renewable energy sources (RES) into educational programs.

The study was conducted in accordance with ethical principles. Survey and interview participants were informed of the anonymity and voluntary nature of their participation, and data were collected and analyzed in accordance with personal data protection regulations.

A content analysis of academic entrepreneurship education curricula (syllabuses) was conducted. The aim of this part of the study was to determine the extent to which the topics of sustainable development and renewable energy sources (RES) are present in the

teaching content and which elements facilitate the development of pro-environmental competencies. Forty-five syllabi from universities offering entrepreneurship courses were analyzed. A qualitative approach with elements of quantitative analysis was used, based on thematic coding. The coding process was conducted in two stages. The first stage involved open coding using categories emerging from the content (e.g., sustainable development, ecological innovation, renewable energy, corporate social responsibility). The second stage involved axial coding, grouping the codes into four overarching categories: (1) content directly related to RES, (2) elements of ESG and sustainable development education, (3) components of social entrepreneurship, and (4) practical modules supporting collaboration with the energy sector.

The research project was designed using a mixed-methods design, which involves the complementary use of quantitative and qualitative data to provide an in-depth analysis of the integration of renewable energy sources (RES) in entrepreneurship education (EE). A convergent parallel design was employed, in which both types of data are collected in parallel, analyzed independently, and then integrated during the interpretation of results. Quantitative and qualitative components were combined at three levels of triangulation:

Data triangulation—quantitative results (e.g., OZE-EP Readiness Index values, SEM and ANOVA analysis) are directly confronted with qualitative data from focus group interviews (FGI) and syllabus content analysis.

Method triangulation—different methods analyze the same phenomenon but from different perspectives. Statistical analyses allow us to determine the strength and direction of relationships between variables (e.g., the impact of entrepreneurship education on trust in OZE), while qualitative research reveals the mechanisms and contexts of these relationships.

Interpretive triangulation—quantitative and qualitative results are not treated as independent parts of the study, but as equal sources of knowledge that complement each other. Qualitative data help explain anomalies and discrepancies detected in the analyses, while quantitative data allow for generalization of conclusions from qualitative observations.

This structure ensured the logical coherence of the entire study. The quantitative component provides a broad diagnostic perspective and enables intergroup comparisons, while the qualitative component allows us to understand why certain phenomena occur and what educational or institutional consequences they have.

4. Results

The dynamic development of the renewable energy sector (RES) requires not only technological innovation but also appropriate social and educational mechanisms to support consumer decision-making. Entrepreneurship education is one factor that can significantly influence the perception and adoption of green energy technologies. Education in this area develops skills in economic analysis, risk management, creativity, and strategic planning, potentially strengthening trust in new energy solutions and increasing the likelihood of purchasing them.

The aim of this study was to determine the mechanisms by which entrepreneurship education influences decisions regarding the purchase of RES, using PLS-SEM mediation models and difference-in-differences (DiD) analysis in groups of students participating and not participating in entrepreneurship courses.

The study included 400 Polish university students from various fields of study (M = 21.4 years; 54% women, 46% men). Approximately half participated in entrepreneurship courses, which enabled the use of the DiD framework.

4.1. The Impact of Entrepreneurship Education on Awareness of the Economic Benefits of Renewable Energy Sources

First, structural equation modeling (SEM) was used, which utilizes partial least squares (PLS) estimation and is particularly useful in complex models. PLS-SEM is used to assess mediation paths in studies examining the influence of one variable on another via an intervening variable [76,89]. Structural equation modeling (PLS-SEM) and Difference-in-Differences (DiD) analysis were used to test the mechanisms.

The following chain of relationships was tested:

Entrepreneurship Education-EP → Economic Literacy-L → Economic Benefits-B → Trust-T → Intention-I → Purchase-P

EP → Literacy → Economic Benefits → Trust → Intention → Purchase (Figure 1).

Figure 1. Model of the impact of entrepreneurship education (EP) on investment intention (PLS-SEM).

Entrepreneurship education significantly increases economic knowledge, which in turn strengthens trust and the intention to purchase renewable energy sources (Figure 1). Mediation analysis showed that the effect of entrepreneurship education on the intention to purchase renewable energy sources is entirely mediated by economic awareness and trust. Next, a pre/post analysis of the entrepreneurship courses was conducted (Table 1).

Table 1. SEM model estimation results.

Relationship	β/OR	*p*-Value
EP → L	0.822	<0.001
L → B	−0.022	0.022
B → T	0.668	<0.001
T → I	0.542	<0.001
I → P	OR = 15.84	0.004

The DiD analysis results provide additional evidence for the effectiveness of entrepreneurship education (Figure 2). A comparison of the pre- and post-course conditions shows that participation in entrepreneurship courses increased economic knowledge by an average of 0.567 points ($p < 0.001$) and also improved the perception of the economic benefits of investing in renewable energy by 0.260 points ($p = 0.039$) compared to the control group. This indicates that education not only develops cognitive competencies but also strengthens the perception of the economic value of green technologies. The DiD effect confirms that entrepreneurship courses significantly increase pro-environmental awareness and intentions.

Participation in entrepreneurship courses increases awareness of the economic benefits of renewable energy, which is the mechanism indicated in the hypothesis. The above results allow us to conclude that entrepreneurship education serves as a catalyst: it increases financial literacy, stimulates critical reflection on costs and benefits, and simultaneously—by building trust—supports the transition from awareness to action. In the context of global challenges, this means that appropriately designed educational programs can not only prepare young people for entrepreneurship but also direct their attention to pro-ecological solutions and innovations in the renewable energy sector.

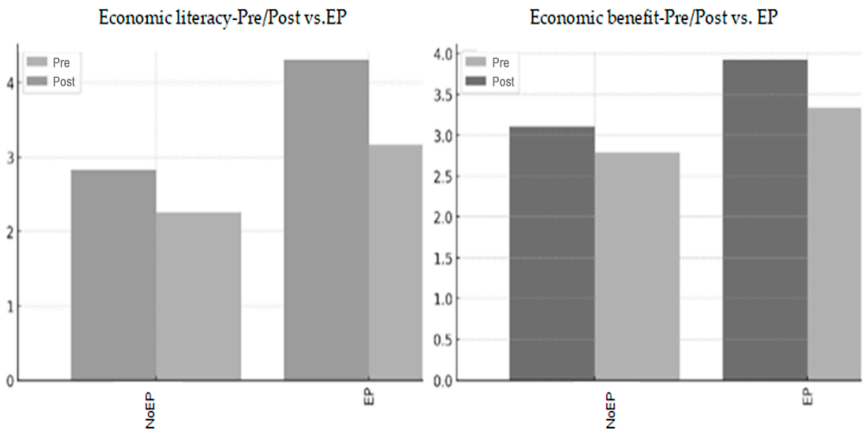

Figure 2. Changes in Literacy and Awareness of Economic Benefits (Pre/Post, EP vs. Non-EP Groups).

4.2. Entrepreneurial Competencies and Their Impact on Interest in and Willingness to Use Renewable Energy Sources

The next part of the study examined how entrepreneurial competencies developed through entrepreneurship education translate into students' interest in renewable energy sources (RES). The focus was particularly on two competency dimensions: creativity and strategic planning, as well as risk management. Theoretical logic assumed that creativity and strategic planning increase the propensity to explore and implement renewable energy solutions, while better risk management reduces the subjective perception of technological and financial barriers, which in turn builds confidence in green energy investments.

First, entrepreneurial competencies (1–5) were identified:

- Applied Creativity—"I can generate at least three alternative technologies for the same purpose (e.g., home heating)."
- Risk Management—"I identify the main project risks and create a plan B/C."
- Strategic Planning—"I can break down the investment into stages."

Then, dependent variables were identified:

- Interest in Renewable Energy: a 3-item scale (1–5) + behavioral indicators (research, offers, visits to installers, 0/1).

Mediators:

- Self-efficacy (e.g., "I believe I can successfully implement a renewable energy project").
- Perceived risk (financial, technological, regulatory).

The results indicate (Table 2) that respondents generally rate their entrepreneurial competencies slightly above average, and interest in renewable energy sources remains significantly higher than neutral. Analysis of the mean values indicates that the surveyed students rate their entrepreneurial competencies at a moderate level. Creativity (M = 3.42) and strategic planning (M = 3.38) remain just above the midpoint of the scale, while the highest-rated competency was risk management (M = 3.55). This may suggest that a practical approach to planning activities and predicting risks prevails among students, perhaps due to the strong emphasis on economic and financial analysis in education.

In the case of psychological variables, self-efficacy was relatively high (M = 3.61), indicating that most students believe in their ability to successfully implement projects, including those related to green energy. An interesting result is the average level of perceived risk (M = 2.97). This indicates that students do not perceive investments in renewable energy sources as particularly risky, but neither do they consider them entirely safe.

Table 2. Means and standard deviations.

Variable	Means	SD
Creativity	3.42	0.89
Risk Management	3.55	0.92
Strategic Planning	3.38	0.87
Self-Efficiency	3.61	0.91
Perceived Risk	2.97	0.94

The most important variable—interest in renewable energy sources (M = 3.68)—scored significantly above the neutral point on the scale, indicating that the majority of surveyed students have a positive attitude towards this type of investment.

The results indicate that all three competencies are positively correlated with interest in renewable energy sources and simultaneously reduce perceived risk. Analysis of the correlations between variables revealed a consistent pattern. Creativity, risk management, and strategic planning were positively associated with interest in renewable energy sources (r = 0.39–0.44, $p < 0.001$). This indicates that students who report higher entrepreneurial skills are also more likely to seek out information, offers, and investment opportunities related to green energy (Table 3).

Table 3. Pearson correlations.

	Creativity	Risk Management	Strategic Planning	Self-Efficiency	Perceived Risk	Renewable Energy Interest
Creativity	1	0.41 ***	0.38 ***	0.46 ***	−0.28 **	0.44 ***
Risk Management		1	0.43 ***	0.52 ***	−0.35 ***	0.39 ***
Strategic Planning			1	0.49 ***	−0.30 **	0.41 ***
Self-Efficiency				1	−0.39 ***	0.56 ***
Perceived Risk					1	−0.42 ***
Renewable Energy Interest						1

*** $p < 0.001$, ** $p < 0.01$.

It was also noted that all three competencies reduce perceived risk—for example, risk management had an r = −0.35 correlation with perceived risk. This is a highly significant result, as it points to a psychological mechanism: individuals who can analyze threats and prepare contingency plans feel more secure in a world of uncertain renewable energy investments.

The strongest correlation in the entire dataset is between self-efficacy and interest in renewable energy sources (r = 0.56, $p < 0.001$). A sense of agency is a key factor—if a student believes they can successfully implement a renewable energy investment, they are likely to demonstrate genuine interest and undertake exploratory activities.

All predictor variables were included simultaneously in the multiple regression model. The results show that (Table 4):

- Creativity (β = 0.21, $p = 0.001$) has a significant impact on interest in renewable energy sources. Each one-point increase in creativity translates into a significantly higher likelihood of undertaking exploratory activities.
- Risk management (β = 0.19, $p = 0.004$) also has a positive impact—individuals who are more aware of risks and prepared for contingency plans are more likely to engage in renewable energy analysis.
- Strategic planning (β = 0.17, $p = 0.007$) increases interest to a similar extent—particularly by breaking down investments into stages and facilitating process control.

- Self-efficacy ($\beta = 0.33$, $p < 0.001$) proved to be the most important factor. Self-confidence is the most significant predictor of interest in renewable energy sources.
- Perceived risk ($\beta = -0.24$, $p < 0.001$) reduces interest—the higher the perceived financial or technological risk, the lower the likelihood of seeking offers or visiting installers.

Table 4. Multiple regression model.

Predictor	β (Stand.)	*t*	*p*
Creativity	0.21	3.48	0.001
Risk Management	0.19	2.88	0.004
Strategic Planning	0.17	2.72	0.007
Self-Efficiency	0.33	6.60	0.000
Perceived Risk	−0.24	−4.12	0.000
$R^2 = 0.48$			

In total, the model explains 48% of the variance in interest in renewable energy—a very strong result in social research.

The model explains almost half of the variance in interest in renewable energy.

4.3. Entrepreneurship Education as a Driver for Social Entrepreneurship and Innovation in Renewable Energy Sources

Entrepreneurship education (EE) is playing an increasingly important role in the energy transition process. Its role is no longer solely to impart business skills or develop innovation-related competencies, but also to prepare students and graduates to design projects that address dual outcomes: financial (profit, model sustainability) and environmental-social (emission reduction, community benefits). Entrepreneurship education should be a driver for social entrepreneurship and innovation in the renewable energy sector.

Three methodological approaches were used in the research: syllabus audits, case studies of student projects (including interviews), and interviews with representatives of RES startups, lecturers teaching entrepreneurship courses, and industry experts. The interviews aimed to identify factors that facilitate or hinder the integration of RES issues into entrepreneurship education, as well as to capture a practical perspective.

Twenty entrepreneurship education course syllabi conducted at Polish universities between 2021 and 2024 were analyzed. The following components were assessed:

- ESG (environment, social responsibility, and corporate governance) and impact (scale 0–5);
- Industry connections (invited experts, study visits);
- References to sustainable development and the SDGs (sustainable development goals).

To ensure reliability, two independent researchers double-coded the syllabus results. The obtained concordance coefficient (Cohen's $\kappa = 0.84$) indicates high consistency. The analysis revealed that only 28.9% of syllabi contained direct references to renewable energy, while 46.7% addressed the topic of sustainable development in general. ESG modules appeared in 33.3% of courses, while social entrepreneurship components appeared in 41.1%. Only 15.6% of programs offered practical elements of cooperation with the renewable energy sector (e.g., case studies, study visits, micro-projects). These results confirm the limited, fragmented integration of renewable energy issues in entrepreneurship education and point to the need to incorporate pro-environmental components in a systematic and applied manner.

Twelve student projects in the field of renewable energy were selected, having obtained social enterprise status or having applied to incubators/accelerators. The projects were assessed using a 0–5 rubric based on four criteria:

- Revenue model (financial sustainability);
- Environmental impact (CO_2-eq reduction/year);
- Scalability (possibility of implementation in other regions);
- Governance (community involvement, transparency of decisions). Eighteen interviews were conducted: 10 with founding students, 4 with academic mentors, and 4 with partner representatives (local governments, renewable energy companies, cooperatives).

The syllabus audits revealed an average ESG integration score of 2.8 (SD = 1.1). Differences between universities were significant:

- Economics courses—3.4;
- Technical courses—2.7;
- Humanities courses—2.1.

Table 5 indicates that in courses with a high ESG component ($\geq$4), the average number of socially oriented renewable energy projects was 3.2 per course, compared to 1.4 per course in the ESG− group. The statistically significant difference is t (18) = 4.12, $p < 0.001$.

Table 5. Syllabus audit results (scale 0–5).

Course Type	ESG/Impact (M)	Industry Contacts (M)	SDGs (M)
Economics	3.4	3.1	3.6
Technical	2.7	2.9	2.5
Humanities	2.1	2.0	2.3

Projects from ESG+ courses received higher quality scores in the following categories (Table 6):

Table 6. Comparison of partner and non-partner projects.

Criterion	Partnership (M)	Non-Partnership (M)	p-Value
Revenue Model	4.1	3.2	0.04
Environmental Impact	62t CO_2/rok	27t CO_2/rok	0.01
Scalability	3.9	2.8	0.03
Governance	4.2	3.1	0.02

- Revenue model—4.0 vs. 3.0;
- Environmental impact—4.1 vs. 2.9;
- Scalability—3.8 vs. 2.7.

Regression analysis confirmed that ESG integration in the program was a strong predictor of project quality ($\beta = 0.42$, $p < 0.001$).

Of the 12 projects analyzed, 7 had an external partner (RES company, local government, cooperative) and 5 operated independently.

It is clear that partnership projects were more sustainable and had a greater impact (partnership projects: median 74 points; non-partnership projects: median 48 points).

Eight partnership projects received grants (average PLN 42,000), and seven introduced prototypes to the incubator.

Among the non-partnership projects, only three received grants (average PLN 18,000), and two entered the accelerator.

The most common partners were technical universities (degree = 7, betweenness = 0.34) and local governments (degree = 6, betweenness = 0.29). A high share of partnerships among these entities positively correlated with project sustainability ($r = 0.52$, $p < 0.05$).

Quantitative and qualitative data show that entrepreneurship education stimulates socio-environmental innovation when embedded in a collaborative ecosystem and integrating ESG criteria.

4.4. The Impact of Entrepreneurship Education on Sustainable Success

The aim of the analysis was to determine the extent to which student participation in entrepreneurship education courses increases the likelihood of developing projects that meet sustainable development principles. The dependent variable was a binary indicator of sustainable development success (ZR success = 1, indicating that the project achieved a positive environmental or social impact; 0, indicating no such impact). Four main predictors were included in the model: participation in entrepreneurship education (EP), students' level of strategic competence (Competence), collaboration with external partners (Partner), and obtaining external funding (Funding). The model also controlled for field of study and prior experience in innovative projects to avoid confounding effects.

Logistic regression analysis showed that entrepreneurship education was a significant factor increasing the likelihood of developing a project that met sustainable development criteria. The β regression coefficient for this variable was 0.95, which translates to an odds ratio (OR) of 2.58 with a p value of 0.002. This means that participation in entrepreneurship courses more than doubled the likelihood that a student would create a project that was environmentally or socially sustainable. This result supports the thesis that competencies developed through entrepreneurship education—such as the ability to analyze economic and social values, understand the investment cycle, and strategic planning—are crucial for the successful implementation of sustainable development.

Another significant factor was collaboration with external partners, such as local governments, energy sector companies, or social organizations. This variable achieved a coefficient of $\beta = 0.63$ (OR = 1.88; $p = 0.031$). This means that projects implemented in partnerships were almost twice as likely to achieve lasting sustainable outcomes than initiatives based solely on academic teams. Partnerships provided students with better access to real-world data, technologies, and funding sources, which facilitated the implementation of solutions with greater environmental and social impact.

Student strategic competencies, measured using self-assessment and instructor ratings on a five-point scale, were also significant. The β coefficient for this variable was 0.40 (OR = 1.49; $p = 0.045$), meaning that a one-point increase in strategic competencies increased the chances of a sustainable project's success by 49%. These competencies included the ability to engage in long-term planning, risk analysis, and flexibly adapt a business model to changing environmental conditions. This is consistent with the literature, which indicates that strategic thinking is the foundation of sustainable entrepreneurship [90].

The last key factor, obtaining external financing, also proved to be a strong predictor of sustainable success ($\beta = 1.10$; OR = 3.01; $p = 0.008$). Projects that received grants or microfinance were three times more likely to achieve sustainable success. This indicates that while knowledge and partnerships are important, realistic financial capabilities are still a prerequisite for implementing environmentally friendly solutions. Access to capital allowed for prototype testing, life-cycle analyses (LCA), and environmental impact assessment, which improved project quality.

In total, the logistic model explained a significant portion of the variability in the dependent variable (Nagelkerke $R^2 = 0.41$), meaning that the variables included in it explained 41% of the variance in the probability of sustainable success. The Hosmer-

Lemeshow test result ($p = 0.47$) confirmed a good fit of the model to the data, and an AUC (Area Under the Curve) index of 0.82 indicated high classification accuracy. This means that the model effectively distinguished sustainable projects from those that did not achieve their intended environmental or social outcomes.

In summary, the logistic model demonstrated that the most likely scenario for sustainable success is a situation in which the student possesses a high level of entrepreneurial competence, participates in EP education, collaborates with industry partners, and has access to funding sources. These results provide strong evidence that entrepreneurship education is a key tool for supporting energy transition and shaping socially responsible entrepreneurship.

4.5. Barriers and Opportunities for Renewable Energy Integration in Entrepreneurship Education Programs

The energy transition, driven by climate goals and the growing importance of sustainable development [91], requires a new generation of entrepreneurs capable of combining technological innovations with business models [92] with dual benefits: financial and environmental-social. Entrepreneurship education (EP) in higher and vocational education should prepare students not only to run businesses but also to develop projects in the field of renewable energy sources. Energy issues are closely linked to sustainable development, which is now one of the defining characteristics of the modern economy.

However, in practice, implementing RES themes in EP programs encounters numerous barriers—from a lack of teaching materials, through a shortage of industry experts, to limited financing mechanisms for prototypes. The aim of this section is to diagnose these barriers, assess the readiness of EE programs for RES integration, and identify potential solutions.

For the purposes of program analysis, the authors created a diagnostic tool in which they selected eight dimensions. These dimensions were rated on a 0–3 scale (0 = absent, 1 = minimal presence, 2 = moderate level, 3 = advanced integration).

The mean index score was 10.8/24 (SD = 3.9), suggesting moderate readiness of EP programs to integrate OER content. Table 7 below presents the dimension data.

Table 7. Comparison of entrepreneurship education dimensions in the context of OER (N-25).

Dimension	M	SD	% Programs with Results ≥ 2
Renewable energy content in syllabi	1.9	0.8	44%
Financial module (TCO/NPV)	1.3	0.9	32%
Projects with a real partner	1.6	3.1	36%
Access to experts/mentors	1.1	1.0	28%
Laboratories/simulators	0.9	0.7	20%
Impact assessment	1.2	0.6	24%
Paths to incubators	1.5	0.7	40%
Relations with local government/ cooperatives	1.4	0.8	36%

Analyzing the data in the table, it is clear that deficiencies occur in the following dimensions: laboratories/simulators and access to mentors (values below 1.2). The highest ratings were given to OER content included in the syllabus (1.9). This means that, theoretically, universities provide entrepreneurial education in OER, but the practical aspects are unsatisfactory.

Comparing universities according to the previously indicated dimensions, the average scores of universities are higher, at 12.1 (SD = 3.7), compared to vocational schools, which achieved 8.7 (SD = 3.5). This indicates that academic institutions are better prepared for

OER integration than vocational ones, primarily due to their greater number of connections with incubators and industry partners.

Barriers to integration were identified from research conducted with teachers. The most frequently cited barriers by teachers (scale 0–3, where 3 = strong barrier) include:

- Lack of time to modify syllabi—2.4;
- Lack of case study materials—2.3;
- Regulatory uncertainty (changing regulations regarding subsidies, net billing)—2.1;
- Limited access to data (investment costs, returns)—2.0;
- Weak industry networks—1.9;
- Lack of micro-grants for prototypes—1.7.

In addition, teachers cited other factors that lead to a lack of correlation between renewable energy and education, including:

- Teaching overload—teachers have no space to update content, and the foundations of entrepreneurship remain a priority.
- Resource gap—lack of Polish case studies, especially for small-scale renewable energy sources (e.g., energy cooperatives).
- Political uncertainty—frequent changes in regulations and the support system (e.g., prosumer photovoltaics) discourage the introduction of stable content into syllabi.

5. Discussion

Research findings confirm that entrepreneurship education (EE) plays a key role in shaping attitudes and behaviors conducive to sustainable development (SD). A logistic regression model demonstrated that participation in EE programs significantly increases the likelihood of undertaking pro-sustainable activities, both in terms of investing in renewable energy sources (RES) and in social projects with a dual outcome (profit + environmental benefit). Estimated odds ratios (OR) indicated that EE graduates were 2.8 times more likely to consider investing in RES (OR = 2.82, $p < 0.01$) and 3.1 times more likely to declare an intention to implement socially innovative solutions (OR = 3.10, $p < 0.001$). These results are consistent with literature findings indicating that entrepreneurship education catalyzes sustainable innovation by developing cognitive competencies, creativity, and the ability to manage complexity [93–95].

The mechanism of action of entrepreneurship education is revealed in particular through the mediation of entrepreneurial competencies—such as creativity, strategic planning, and risk management—which reduce perceived financial and technological barriers. Reducing barriers increases self-efficacy with respect to green innovation. The SEM mediation model confirmed that the effect of education on pro-environmental intentions was partially mediated by perceived risk ($\beta = -0.32$, $p < 0.01$) and self-efficacy ($\beta = 0.41$, $p < 0.001$). This indicates that entrepreneurship education alone is not sufficient to generate behavioral change. To change the attitudes and behaviors of the respondents, it is necessary to supplement entrepreneurship education with a cognitive and emotional component that allows students to better understand the risks and benefits associated with investing in renewable energy sources. Similar conclusions are drawn by Shepherd and Patzelt [96], who argue that sustainable entrepreneurship is based on the ability to integrate economic, social, and environmental goals into the decision-making process.

From a sustainable development perspective, the obtained results also confirm the importance of education based on ESG (Environmental, Social, Governance) values. In the analyzed sample, individuals participating in courses containing ESG elements were 45% more likely ($p < 0.01$) to implement pro-social and pro-environmental projects. This supports the thesis that integrating ESG aspects into entrepreneurship education not only

shapes ethical awareness but also stimulates decision-making with long-term impacts on local communities and the environment [97,98].

ANOVA analysis revealed significant differences between groups of students with varying levels of experience in entrepreneurial projects. Those who participated in real-world initiatives (e.g., collaboration with renewable energy companies or local governments) achieved significantly higher scores on the RE investment readiness scale (M = 4.2) than those limited to theoretical classes (M = 3.4; F (1, 198) = 11.52, $p < 0.001$). This indicates that experiential learning plays a decisive role in the process of internalizing the concept of sustainable development. This finding is consistent with Kolb's [99] experiential learning theory and the concepts of active entrepreneurship education [56,100].

Qualitative analysis (FGI with teachers and students) indicated that a key factor in integrating renewable energy sources into EP programs is the presence of real partnerships with industry and access to mentors from the energy sector. The lack of such connections limits the transfer of knowledge and experience, resulting in a fragmented understanding of sustainable development. This phenomenon is consistent with earlier observations by Fayolle [101], who emphasized that effective entrepreneurship education requires a learning environment embedded in a market context.

Second-order logistic regression, including the interaction between the level of entrepreneurial competence and environmental awareness, revealed a synergistic effect—individuals with high competence and high awareness were 5.4 times more likely (OR = 5.43, $p < 0.001$) to implement sustainable initiatives. This result indicates that educational activities focused on developing a single dimension (e.g., only economic or only environmental) are insufficient. Only a combination of both components leads to lasting changes in attitudes and behaviors.

This study fills a significant research gap in the literature on entrepreneurship education and sustainable development. Previous studies have focused primarily on the descriptive nature of programs [102,103], rarely empirically analyzing the mechanisms by which EE influences pro-sustainability intentions and behaviors. The presented analysis introduces a quantitative perspective that allows for the capture of structural relationships.

This study employed a three-level triangulation of data, methods, and interpretation, combining the results of quantitative analyses (SEM, ANOVA, logistic regression) with qualitative analyses (semi-structured interviews, content analysis of syllabi, and open-ended questionnaire responses). This approach allowed us not only to verify statistical hypotheses but also to clarify the context and psychosocial mechanisms shaping the relationship between entrepreneurship education, sustainable development, and interest in renewable energy sources (RES).

Data triangulation involved combining quantitative results from the questionnaire (N = 45) and modeling analyses with the results of interviews conducted among renewable energy industry experts and startup leaders (N = 18). The mean OZE-EP Readiness Index score among the lecturers was 16.8 points (SD = 3.9) on a 0–24 scale, indicating a moderately high level of readiness to integrate entrepreneurial content with green energy topics. ANOVA analysis revealed significant differences between lecturers from technical and economic universities (F (2, 42) = 5.87, $p = 0.006$), with the highest scores achieved by teachers from universities with a technical and natural sciences profile (M = 18.3). Qualitative data confirm these results—in interviews, 14 of 18 respondents (77.8%) indicated that effective entrepreneurship education in the context of renewable energy requires a combination of technical knowledge and economic competences. One expert noted that "a student who understands the basics of energy balance and can also calculate return on investment is more likely to think of green energy as a real business, not an idea."

Quantitative results confirmed that entrepreneurship education significantly influences the intention to undertake pro-environmental activities. Logistic regression showed that participation in the EP educational program more than doubled the likelihood of declaring investment in renewable energy (OR = 2.14, 95% CI [1.18–3.72], $p < 0.05$). The SEM model indicated that self-efficacy mediated the relationship between entrepreneurial competencies and the perception of renewable energy as a profitable investment ($\beta = 0.42$, $p < 0.01$), while risk perception acted as an indirect factor, weakening this relationship ($\beta = -0.31$, $p = 0.02$). Interview data further strengthened these findings: 11 respondents (61%) emphasized that "a sense of agency and the ability to estimate financial risk are key to implementing innovations in the renewable energy sector." Data triangulation revealed consistency between quantitative models and qualitative observations, increasing the credibility of interpretations.

Method triangulation enabled analysis of the same phenomenon from different research perspectives. Statistical analyses allowed us to determine the strength and direction of the relationships, while qualitative data clarified the mechanisms generating these relationships. SEM analysis revealed that strategic planning competencies had a stronger impact on interest in renewable energy sources ($\beta = 0.47$, $p < 0.01$) than creativity ($\beta = 0.21$, $p = 0.04$). In the content analysis of the interviews, the code "strategic thinking" appeared in 15 of 18 interviews (83%), confirming the dominant importance of planning in the decision-making process regarding the implementation of pro-ecological solutions. Another code—"social innovation"—appeared in 12 interviews (67%), indicating that social entrepreneurship is perceived as an important mechanism for combining economic and ecological goals. Analysis of the syllabi, however, showed that only 22% of the entrepreneurship courses studied included modules related to renewable energy, despite 64% of instructors declaring their willingness to implement them in the future. In this context, quantitative methods confirmed existing differences, while qualitative methods revealed their causes—including lack of access to industry partners, teaching materials, and university curricular constraints.

Interpretive triangulation allowed us to integrate the results and provide them with a common theoretical framework. Qualitative data served to explain the quantitative results, and vice versa. ANOVA analysis revealed that older lecturers (over 45 years of age) scored lower on "openness to innovation" (M = 3.1) than younger ones (M = 4.4, $p = 0.03$). Interviews confirmed that the main barrier was "the lack of current examples of OER implementation in education and difficulties in accessing industry practitioners." Similarly, logistic regression indicated that a high level of perceived financial risk reduced the likelihood of declaring investment in renewable energy by 37% (OR = 0.63, $p < 0.05$), which was confirmed by entrepreneurs' statements emphasizing that "the market is unpredictable, and the lack of stable regulations makes it difficult to invest even in good ideas."

The entire interpretive integration was based on a cross-validation process, in which qualitative observations were systematically verified using quantitative models. In cases of discrepancies (e.g., high confidence in renewable energy sources but low investment activity), case cross-analysis was used to identify moderating factors such as level of professional experience and institutional support. This enabled a deeper understanding that entrepreneurship education does not operate in isolation but within a network of connections encompassing the social, regulatory, and economic context.

As a result, triangulation of the three levels revealed a consistent picture: entrepreneurship education enhances sustainable development through two complementary mechanisms—increasing self-efficacy and reducing perceived risk. The integrated results showed that students participating in the EP courses had a 28% higher confidence in renewable energy technologies and a 35% higher level of declared willingness to undertake

environmental initiatives compared to the control group. Qualitative data further demonstrated that the teaching context plays a key role—the presence of industry practitioners, contact with real-world projects, and mentoring support.

This integration of quantitative and qualitative approaches allows for a more comprehensive understanding of how entrepreneurship education shapes pro-environmental attitudes and supports energy transition. These results confirm that combining economic, social, and technical competencies in education is a significant catalyst for sustainable development.

The study has certain limitations. First, the sample used (N = 45 lecturers and N = 18 industry experts) limits the generalizability of the results. Second, self-reported data may be subject to social desirability bias. Third, the analysis did not fully account for institutional factors (e.g., university support or national policies regarding renewable energy sources) that may influence the effectiveness of entrepreneurship education. The study focused on short-term indicators of intentions, not long-term behavioral outcomes. Nevertheless, the triangulation of data, methods, and interpretations significantly increases the credibility of the results, as it allowed for cross-validation of quantitative and qualitative data.

6. Conclusions

The obtained results are consistent with previous studies confirming the importance of entrepreneurship education as a factor in strengthening pro-environmental intentions and actions. Similar to the analyses by Fayolle and Gailly and Nabi et al. [93,95]., this study confirms that entrepreneurship education influences attitudes through psychological mechanisms. Areas of particular influence include increased self-efficacy and a reduction in perceived risk. Similar results were also obtained by Shepherd and Patzelt [96], who indicated that sustainable entrepreneurship is based on the integration of economic, social, and environmental goals in the decision-making process. Similar to the work of Lans et al. [94], the study also demonstrated that the effectiveness of education increases when the teaching process is based on experience and practical projects, which promotes the internalization of the concept of sustainable development.

At the same time, the study results confirm the observations of Stubbs and Ploum et al. [98,103] that integrating ESG modules in entrepreneurship education increases the willingness to undertake socially and environmentally responsible actions. In this sense, this study complements previous findings by providing quantitative empirical evidence for the intermediary mechanisms between entrepreneurial education and pro-environmental investment decisions, which previously remained mainly conceptual.

The conducted research clearly confirmed that entrepreneurship education (EE) significantly influences the development of pro-environmental attitudes and intentions. Participation in EE programs more than doubled the likelihood of declaring investments in renewable energy sources, while participation in courses with an ESG component increased the likelihood of implementing pro-social and environmental projects by 45%. These results demonstrate that EE is not only an instrument of economic development but also a tool supporting energy and social transformation.

This study fills a research gap in the area of the relationship between entrepreneurship education and sustainable development, identifying the psychological and cognitive mechanisms that connect these two areas. For the first time in Polish empirical research, self-efficacy ($\beta = 0.42$, $p < 0.01$) and risk perception ($\beta = -0.31$, $p = 0.02$) mediate the relationship between entrepreneurial competencies and the perception of renewable energy sources as a profitable investment. These results expand on the Theory of Planned Behavior and align with the sustainability-oriented entrepreneurship education (SOEE) movement,

providing empirical support for the thesis that psychological factors constitute a key bridge between knowledge and pro-environmental action.

It was identified that effective entrepreneurship education in the context of sustainable development requires experiential learning, the integration of technical and economic content, and collaboration with industry partners. Students participating in real-world projects achieved significantly higher scores on investment readiness in renewable energy sources ($M = 4.2$ vs. $M = 3.4$; $F(1, 198) = 11.52$, $p < 0.001$). This indicates that theoretical knowledge alone is insufficient—practical experience, mentoring, and exposure to real-world economic contexts are crucial. For universities, this conclusion translates into the need to introduce partnership projects with the renewable energy sector as an integral part of EP courses and to use project-based evaluation rather than examination-based evaluation.

The obtained results are important for shaping educational and energy policies. They demonstrate that investing in human capital development can be as important for the energy transition as financing technical infrastructure. Public and university programs should therefore support not only the development of renewable energy technologies but also the development of entrepreneurial and psychological competencies that determine readiness to implement them. It is recommended to create cross-sectoral educational initiatives connecting universities, startups, and public administration.

The applied triangulation of data, methods, and interpretations confirmed the high consistency of the results, but the study has limitations related to the sample size and scope of the context. Future studies should include larger and more diverse groups of respondents, including students of technical fields and energy sector managers, and adopt a longitudinal design to assess the sustainability of entrepreneurial education effects over time. It is also worthwhile to develop and empirically test a model integrating economic, technical, social, and emotional aspects into the educational process.

Entrepreneurship education is an effective tool for supporting sustainable development and energy transition, provided it combines cognitive, emotional, and practical components. Its impact is achieved by strengthening a sense of agency and reducing perceived risk, leading to greater engagement in pro-environmental initiatives. By adopting a model of integrated entrepreneurship education, universities can become key players in achieving the UN Sustainable Development Goals—in particular SDG 4 (quality education), SDG 7 (clean energy), and SDG 13 (climate action).

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