

The levels of entrepreneurship and innovation culture in achieving sustainable development goals: A case study

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Abstract

This study examines the levels of entrepreneurship and innovation culture among private university students in northern Jordan in achieving the Sustainable Development Goals (SDGs). It employed a descriptive survey methodology; a questionnaire was developed to measure entrepreneurship and innovation culture in achieving the SDGs. The study sample comprised 461 male and female students from private universities in northern Jordan. The results show that the level of entrepreneurship and innovation culture in the pursuit of the SDGs among private university students in northern Jordan is moderate. In addition, the results reveal no statistically significant differences attributable to gender. In contrast, statistically significant differences are found for college type, favoring students in science colleges, and for year of study, favoring fourth-year students. The study offers a novel contribution by examining entrepreneurship and innovation culture in relation to the SDGs within the underexplored context of private universities in northern Jordan, integrating behavioral, educational, and sustainability perspectives.

Keywords: entrepreneurship, innovation, sustainable development goals, higher education, private universities, university students.

Introduction

Sustainable development is one of the most important contemporary global trends, aiming to achieve a balance between economic, social, and environmental dimensions. This balance ensures that the needs of the present generation are met without compromising the ability of future generations to meet their own needs (United Nations, 2023). This vision is embodied in SDGs, adopted by the United Nations as a global framework for development until 2030. In this context, several goals directly related to entrepreneurship and innovation are particularly important, most notably SDG 4 on quality education, SDG 8 on decent work and economic growth, and SDG 9 on industry, innovation, and infrastructure.

In light of these trends, entrepreneurship and innovation have emerged as key drivers for achieving the SDGs. Entrepreneurship contributes to job creation, stimulates economic growth, and improves productivity levels. Innovation, on the other hand, is a fundamental mechanism for developing products, services, and solutions that address contemporary economic, social, and environmental challenges (Altwaijri et al., 2024). In addition, entrepreneurship and innovation are complementary processes. Entrepreneurship involves discovering opportunities, developing ideas, and transforming them into viable projects, while innovation provides the driving force that enables these projects to be sustainable, competitive, and generate added value (Drucker, 2023).

In light of rapid economic and technological transformations, a culture of entrepreneurship and innovation has become a strategic necessity for preparing individuals. These individuals can adapt to the demands of the knowledge economy and actively participate in sustainable development. University students are among the groups best positioned to absorb this culture and utilize it to find innovative solutions to societal challenges, given their creative energies and capacity for learning and change. Additionally, an entrepreneurial culture contributes to developing skills in creative thinking, opportunity seizing, problem-solving, initiative, and

building the capabilities necessary to establish entrepreneurial projects. Positively, this impacts the achievement of sustainable economic growth and the promotion of decent work opportunities (Lazarte-Aguirre et al., 2024; Planck et al., 2024; Yarkin & Yesil, 2016).

Consequently, entrepreneurial education has become a fundamental component of the modern higher education system. Universities are no longer limited to simply transmitting knowledge; they now also encompass developing entrepreneurial and innovative skills capable of transforming knowledge into sustainable economic and social value. Through their academic programs, training activities, business incubators, and innovation centers, universities contribute to fostering positive attitudes toward entrepreneurship and promoting entrepreneurial practices among students. This supports the achievement of SDGs, particularly Goals 4, 8, and 9 (Galvão et al., 2020; Lechuga-Jiménez et al., 2024).

Universities also play a pivotal role in building integrated entrepreneurial ecosystems by fostering partnerships with the private sector and civil society organizations. They provide supportive environments for innovation and entrepreneurship, enabling students to develop their ideas and transform them into viable projects with sustainable economic and developmental impact (Hammouri & Al Bataineh, 2024). These roles are becoming increasingly important in private universities. These universities strive to align their educational outcomes with labor market needs, promote a culture of entrepreneurship and self-employment, and prepare graduates with the skills necessary to compete in the knowledge economy (Elmobayed, 2022; Leal Filho et al., 2025).

At the Arab level, recent years have witnessed a growing interest in promoting entrepreneurship and innovation as key drivers of sustainable development. Many countries and educational institutions have adopted initiatives and programs aimed at developing entrepreneurial skills among young people, stimulating innovation, and improving educational outcomes. These initiatives also aim to enhance the contribution of universities to economic and social development (UNESCWA, 2023). However, the literature still indicates disparities in the levels of entrepreneurship and innovation culture among university students, depending on the educational environment and socioeconomic contexts. In addition, the relationship between entrepreneurial and innovation culture and the achievement of SDGs still requires further research, particularly within Arab university settings.

Theoretically, this study is based on Ajzen's (1991) Theory of Planned Behavior, one of the most widely used theories for explaining entrepreneurial behavior. This theory posits that human behavior is shaped by three main components: attitudes toward behavior, self-efficacy, and perceived behavioral control. These components collectively influence behavioral intention and, consequently, actual behavior. In the context of entrepreneurship, this theory helps explain the relationship between entrepreneurial awareness, attitudes toward entrepreneurship, and entrepreneurial practices among university students. It also clarifies how an entrepreneurial culture can foster active participation in achieving the SDGs.

The significance of this study stems from exploring the levels of entrepreneurship and innovation culture in achieving the SDGs among private university students in northern Jordan. It also reveals differences related to certain demographic and academic variables. In addition, it expands the application of planned behavior theory within the context of sustainable entrepreneurship in Arab higher education institutions. It provides empirical evidence demonstrating the role of the educational environment and academic experience in shaping an entrepreneurial culture linked to sustainable development. This may fill a gap in contemporary Arabic literature on the subject. The current study sought to answer the following question:

1. What is the level of entrepreneurial and innovation culture in achieving the SDGs among students at private universities in northern Jordan?

2. Are there statistically significant differences at ($\alpha = 0.05$) in the study sample's assessments of the levels of entrepreneurship and innovation culture in achieving the SDGs among private university students in northern Jordan, attributed to gender, college type, and academic year?

Methods

Research design

This study adopted the descriptive survey method as it is well-suited to the nature and objectives of the research. A questionnaire was used as the primary tool for collecting quantitative data from the study sample of private university students in northern Jordan. This data was then statistically analyzed to arrive at the results and interpret them in light of relevant theoretical literature and previous studies.

Population and sample

The study population consisted of all undergraduate students enrolled in private universities located in northern Jordan during the second semester of the 2025/2026 academic year. The estimated size of the study population was approximately 30,000 students, based on official data and statistics available from the universities included in the study.

To determine the appropriate sample size, the Krejcie and Morgan (1970) sample size table was used, which is one of the most common methods for determining sample sizes in educational and social studies. This table indicates that the appropriate sample size for a population of 30,000 individuals is 379. The study data was collected through an electronic questionnaire distributed in collaboration with the research deanships of the targeted universities. The data collection process resulted in the return of 461 valid questionnaires for statistical analysis, a number exceeding the minimum required according to the Krejcie and Morgan table. This number would enhance the representativeness of the sample within the study population and increase the reliability and generalizability of the results in the target population.

The study employed electronic convenience sampling. The questionnaire was distributed electronically to students at the private universities included in the study, in coordination with their respective deans of scientific research. Participation was open to all members of the target population on a voluntary basis. A total of 461 questionnaires were deemed valid for statistical analysis. Regarding the demographic characteristics of the sample, the results showed that males constituted 54.0% of the total sample (249 students), while females comprised 46.0% (212 students). The results also indicated that the majority of the sample (54.9%) (253 students) were enrolled in science colleges, compared to 45.1% (208 students) in humanities colleges. As for the academic year, the sample was distributed across various academic levels. First-year students constituted the highest percentage (33.4%), followed by third-year students (24.1%), and then fourth-year students (22.3%). Second-year students accounted for (20.2%).

Instrument

To achieve the study's objectives and answer its questions, a questionnaire was developed to measure the levels of entrepreneurship and innovation culture in achieving the SDGs among private university students in northern Jordan. The questionnaire items were constructed based on recent theoretical literature related to entrepreneurship, innovation, and sustainable development. Several peer-reviewed international studies and reports in this field were also consulted. These included reports from the Organisation for Economic Co-operation and Development (OECD), which emphasized the importance of integrating entrepreneurial education into higher education to enhance students' skills and support a knowledge-based economy (OECD, 2024). They also included reports from UNESCO, which highlighted the role of education in supporting the transition to sustainable development and building entrepreneurial capacities among young people (UNESCO, 2023). Recent studies addressing the role of university education in fostering an entrepreneurship and innovation culture were also utilized. These studies confirmed the importance of the university environment and partnerships with the community and the labor market in promoting entrepreneurial intention

among students, developing innovation skills, and turning ideas into viable projects (Bischoff et al., 2018; Galvão et al., 2020; Lechuga-Jiménez et al., 2024; Okuogume & Toledano, 2024; Planck et al., 2024).

Accordingly, the questionnaire items were formulated to align with the relevant SDGs: Goal 4 (Quality Education), Goal 8 (Decent Work and Economic Growth), and Goal 9 (Industry, Innovation, and Infrastructure). The questionnaire items were linked to these goals based on the nature and content of each item. This would ensure the measurement of awareness, attitudes, and entrepreneurial practices, as well as an assessment of the contribution of a culture of entrepreneurship and innovation to supporting sustainable development pathways and achieving their goals. The study instrument (the questionnaire), in its final form after verifying its validity and reliability within the Jordanian context, consisted of (34) items distributed across four main domains: Domain 1: Awareness of the concepts of entrepreneurship, innovation, and sustainable development (8 items). Domain 2: Attitudes towards entrepreneurship and innovation (8 items). Domain 3: Entrepreneurial practices and participation (8 items). Domain 4: The contribution of a culture of entrepreneurship and innovation to achieving the SDGs (10 items).

The questionnaire employed a five-point Likert scale for answering the items. The alternatives (strongly agree, agree, neutral, disagree, strongly disagree) were assigned weights of 5, 4, 3, 2, and 1, respectively. The following scale was adopted for analyzing the results: 1.00–2.33 (low); 2.34–3.67 (moderate); and 3.68–5.00 (high). The scale was calculated using the following equation: (Upper limit of the scale (5) – Lower limit of the scale (1)) / Number of required categories (3) = $(5-1) / 3 = 1.33$. The value of (1.33) was then incrementally added to define the limits of each of the three rating categories.

Validity

To verify the validity of the research instrument, two methods were adopted: content validity and construct validity. Regarding content validity, the questionnaire, in its initial form, was presented to a panel of expert reviewers specializing in educational foundations, educational administration, curriculum and teaching methods, entrepreneurship, and measurement and evaluation at several Jordanian universities. They verified the suitability of the items to the study's objectives and scope, the clarity of their language, the soundness of their scientific content, and their comprehensiveness in covering the dimensions to be measured. Based on the reviewers' comments and suggestions, necessary modifications were made to some items in terms of wording, deletion, and addition. As a result, the instrument, in its final form, became more suitable for achieving the study's objectives, thus providing appropriate indicators of content validity.

Construct validity was verified by administering the instrument to a pilot sample of 30 students (male and female) outside the original study sample. Pearson correlation coefficients were calculated between each item and the total instrument score, and between each item and its corresponding domain. The results showed that the correlation coefficients between the items and their respective domains ranged from 0.34 to 0.60, while the correlation coefficients between the items and the total instrument score ranged from 0.33 to 0.68. All correlations were positive and statistically significant at the significance level ($\alpha \leq 0.01$).

Reliability

To verify the reliability of the research instrument, internal consistency and test-retest methods were used. For test-retest reliability, the instrument was administered to a pilot sample of 30 students (male and female) outside the main study sample. It was then administered to the same sample two weeks later, and Pearson's correlation coefficient was calculated between the two administrations. Internal consistency coefficients were calculated using Cronbach's alpha for each subdomain and for the overall score. The results showed that internal consistency coefficients ranged from 0.72 to 0.81 for the subdomains and reached 0.87 for the instrument

as a whole. Test-retest reliability coefficients ranged from 0.82 to 0.87 for the subdomains and reached 0.92 for the overall score.

Results

Level of entrepreneurship and innovation culture in achieving the SDGs

Table 1. Means and standard deviations

Rank	No.	Domain	M	SD	Level
1	2	Attitudes towards entrepreneurship and innovation	2.81	0.47	Moderate
2	1	Awareness of the concepts of entrepreneurship, innovation, and sustainable development	2.79	0.56	Moderate
3	4	Contribution of a culture of entrepreneurship and innovation to achieving the SDGs	2.71	0.45	Moderate
4	3	Entrepreneurial practices and participation	2.55	0.42	Moderate
		Total score	2.71	0.36	Moderate

Table 1 shows that the levels of entrepreneurship and innovation culture in achieving the SDGs among private university students in northern Jordan was moderate overall. The overall mean score was 2.71 with a standard deviation of 0.36. This result indicates that students possess a moderate level of entrepreneurship and innovation culture related to achieving the SDGs.

At the domain level, the domain of attitudes towards entrepreneurship and innovation ranked first with a mean score of 2.81 and a standard deviation of 0.47, indicating a moderate level. This result suggests that students adopt relatively positive attitudes towards entrepreneurship and innovation. They also demonstrate a reasonable willingness to accept entrepreneurial ideas and innovative initiatives.

The domain of awareness of the concepts of entrepreneurship, innovation, and sustainable development ranked second with a mean score of 2.79 and a standard deviation of 0.56, at a moderate level. The results indicate that students possess an acceptable level of knowledge regarding the basic concepts related to entrepreneurship and innovation and their relationship to sustainable development. However, this awareness has not yet reached a high level.

The domain of the contribution of entrepreneurship and innovation culture to achieving the SDGs ranked third with a mean score of 2.71 and a standard deviation of 0.45, indicating a moderate level. This result reflects students' awareness of the role that an entrepreneurship and innovation culture can play in supporting SDGs, but not to a degree sufficient to achieve a tangible and widespread impact.

Meanwhile, the domain of entrepreneurial practices and participation ranked fourth with a mean score of 2.55 and a standard deviation of 0.42, although it remained within the moderate level. This result indicates a gap between the cognitive and attitudinal aspects, on the one hand, and the practical application and actual participation in entrepreneurial activities and initiatives, on the other. The results can be illustrated in Figure 1.

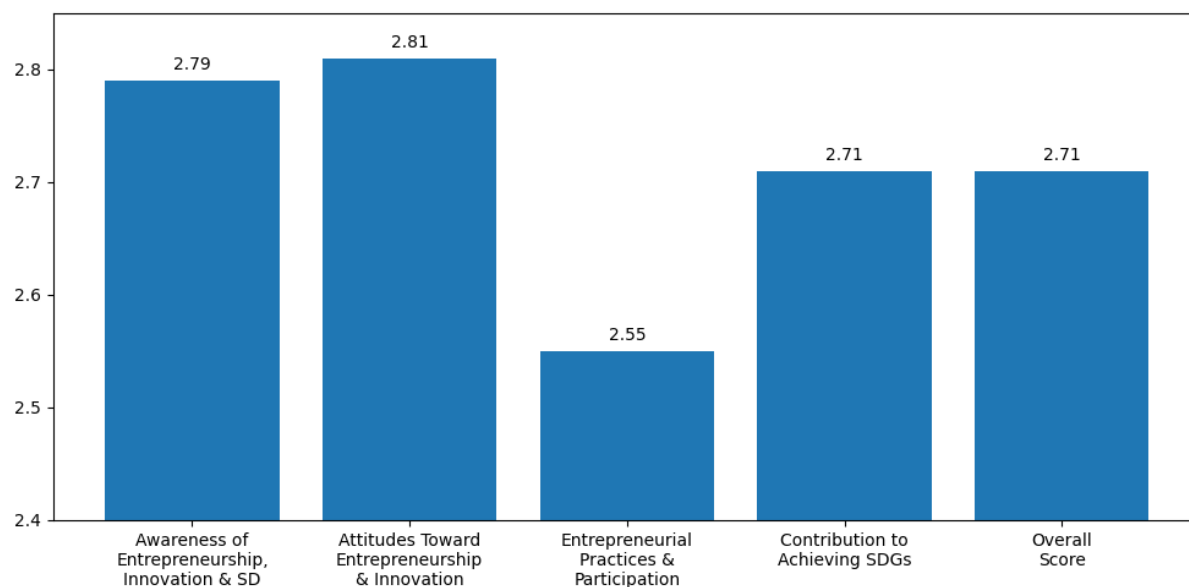


Figure 1. Means for the domains of the study tool and the total score

Differences based on the demographic variables

Table 2. Means and standard deviations

Variables	Categories	M S D	Awareness of the concepts of entrepreneurship, innovation, and sustainable development	Attitudes towards entrepreneurship and innovation	Entrepreneurial practices and participation	Contribution of a culture of entrepreneurship and innovation to achieving the SDGs	Total score
Gender	M	M	2.84	2.77	2.52	2.70	2.71
		SD	.540	.470	.420	.450	.340
	F	M	2.73	2.87	2.58	2.71	2.72
		SD	.570	.450	.400	.440	.360
College	Humanities	M	2.70	2.72	2.48	2.68	2.65
		SD	.520	.450	.350	.440	.310
	Sciences	M	2.87	2.88	2.61	2.72	2.77
		SD	.580	.460	.450	.450	.380
Year	First	M	2.71	2.81	2.54	2.69	2.69
		SD	.540	.480	.330	.410	.340

	Second	M	2.52	2.70	2.48	2.54	2.56
		SD	.420	.440	.330	.420	.290
	Third	M	2.93	2.80	2.53	2.65	2.72
		SD	.580	.480	.500	.440	.360
	Fourth	M	3.01	2.93	2.65	2.93	2.88
		SD	.550	.440	.460	.420	.350

Table 2 reveals apparent differences in the mean scores for entrepreneurship and innovation culture in achieving the SDGs among private university students in northern Jordan, based on gender, college type, and year of study. These differences were observed at both the sub-domain and overall score levels.

Regarding gender, the results indicate a close approximation of the mean scores between males and females at the overall level, with males scoring 2.71, compared to females, scoring 2.72. At the sub-domain level, males outperformed females in awareness of entrepreneurship, innovation, and sustainable development concepts, scoring 2.84 compared to females, scoring 2.73. However, females outperformed males in attitudes toward entrepreneurship and innovation, scoring 2.87 compared to males, scoring 2.77. Similarly, females outperformed males in entrepreneurial practices and participation, scoring 2.58 compared to males, scoring 2.52. The contribution of entrepreneurship and innovation culture to achieving the SDGs showed a clear convergence between genders. The mean score was 2.70 for males and 2.71 for females. These results indicate that the levels of entrepreneurship and innovation culture is similar between the genders, with slight differences in certain cognitive and behavioral aspects. As for the college variable, the results showed that science college students outperformed humanities college students in all areas and in the overall score. The mean score for science college students was 2.77, compared to 2.65 for humanities college students. Science college students also recorded the highest mean scores in awareness of entrepreneurial and developmental concepts (2.87), attitudes toward entrepreneurship and innovation (2.88), entrepreneurial practices and participation (2.61), and the contribution of entrepreneurship and innovation culture to achieving the SDGs (2.72). This result may reflect the nature of the academic programs in science colleges, which place greater emphasis on innovation, problem-solving, and practical and technical applications. Thus, it fosters an entrepreneurial culture among students.

Regarding the academic year variable, the results showed a gradual increase in arithmetic means with progression through the academic level: fourth-year students recorded the highest overall arithmetic mean score of 2.88, followed by third-year students with 2.72, and then first-year students with 2.69. Second-year students had the lowest arithmetic mean score of 2.56. Fourth-year students also achieved the highest averages in most areas. Their average scores were awareness of entrepreneurial and developmental concepts (3.01), attitudes towards entrepreneurship and innovation (2.93), entrepreneurial practices and participation (2.65), and the contribution of a culture of entrepreneurship and innovation to achieving the SDGs (2.93). These results indicate that progression through university studies contributes to the development of students' entrepreneurial knowledge, attitudes, and experiences because of the accumulation of academic experiences and participation in relevant university activities and programs.

Table 3. Multi-triangular variance analysis

Source of variance	Domains	Sum of squares	df	Means of squares	F	Sig.	Effect size
Gender	D1	.074	1	.074	.408	.523	.001
Hotelling=.032	D2	.695	1	.695	3.315	.069	.007
p=.006	D3	.192	1	.192	1.151	.284	.003
	D4	.077	1	.077	.421	.517	.001
College	D1	1.657	1	1.657	5.986	.015	.013
Hotelling=.058	D2	2.515	1	2.515	12.002	.001	.026
p=.000	D3	1.756	1	1.756	10.511	.001	.023
	D4	2.648	1	2.648	9.567	.002	.021
Year	D1	13.934	3	4.645	16.781	.000	.100
Wilks=.841	D2	1.777	3	.592	2.828	.038	.018
p=.000	D3	1.224	3	.408	2.442	.064	.016
	D4	8.221	3	2.740	15.015	.000	.090
Error	D1	125.940	455	.277			
	D2	95.335	455	.210			
	D3	76.005	455	.167			
	D4	83.038	455	.183			
Total	D1	144.831	460				
	D2	101.051	460				
	D3	79.558	460				
	D4	91.468	460				

D1=Awareness of the concepts of entrepreneurship, innovation, and sustainable development

D2=Attitudes towards entrepreneurship and innovation

D3=Entrepreneurial practices and participation

D4=Contribution of a culture of entrepreneurship and innovation to achieving the SDGs

The results, presented in Table 3, indicate a variation in the impact of the independent variables on the studied domains.

Regarding gender, the multiple-choice results showed no statistically significant effect of gender on the combined domains of entrepreneurship and innovation culture. Hotelling's Trace value was 0.032, and the p-value was 0.006. However, subsequent one-way analyses revealed no statistically significant differences between males and females in any of the subdomains. The statistical significance values for the domain of awareness of entrepreneurial concepts and sustainable development were 0.523, for the domain of attitudes towards entrepreneurship and innovation (0.069), for the domain of entrepreneurial practices and participation (0.284), and for the domain of the contribution of entrepreneurial and innovation culture to achieving the SDGs (0.517). All of which are greater than the significance level ($\alpha = 0.05$). The effect size values (η^2) also showed a very low range between 0.001 and 0.007. This result indicates that gender does not represent a significant factor in shaping students' entrepreneurial and innovation culture.

As for the college type variable, the results revealed a statistically significant effect of college type on all domains combined. The Hotelling's Trace value was 0.058 at a statistical significance level ($p < 0.001$). In addition, one-way analyses showed statistically significant differences in all domains in favor of one of the two college types. The F-value was 5.986 (0.015) for awareness of entrepreneurship, innovation, and sustainable development concepts; 12.002 (0.001) for attitudes toward entrepreneurship and innovation; 10.511 (0.001) for entrepreneurial practices and participation; and 9.567 (0.002) for the contribution of entrepreneurial and innovation culture to achieving the SDGs. Based on the means presented in Table 2, these results indicate that the differences favored students in science colleges. The

effect sizes ranged from 0.013 to 0.026, which are small according to common statistical standards. This result suggests that college type explains only a small portion of the variance in entrepreneurial and innovation culture.

Concerning the academic year variable, the results showed a statistically significant effect across all domains, with a Wilks' Lambda value of 0.841 at $p < 0.001$. At the subdomain level, statistically significant differences emerged in awareness of entrepreneurship, innovation, and sustainable development concepts ($F = 16.781$, $p < 0.001$), attitudes toward entrepreneurship and innovation ($F = 2.828$, $p = 0.038$), and the contribution of entrepreneurial and innovation culture to achieving the SDGs ($F = 15.015$, $p < 0.001$). In contrast, no statistically significant differences were found in entrepreneurial practices and participation, with 0.064, which is greater than 0.05. The effect size values indicate that the strongest effect of academic year was in the domains of awareness of entrepreneurial concepts and sustainable development ($\eta^2 = 0.100$) and the contribution of entrepreneurship culture to achieving the SDGs ($\eta^2 = 0.090$). These values fall within the medium effect level according to Cohen's classification, while the effect size was weak in the remaining areas.

Table 4. Three-way analysis of variance (NOVA)

Source of variance	Sum of squares	df	Means of squares	F	Sig.	Effect size
Gender	.027	1	.027	0.237	0.627	0.001
College	1.141	1	1.141	9.911	0.002	0.021
Year	4.717	3	1.572	13.662	0.000	0.083
Error	52.367	455	.115			
Total	58.758	460				

Table 4 indicates differences in the levels of entrepreneurship and innovation culture attributable to some of the studied variables but not others.

Regarding the gender variable, the results showed no statistically significant differences in the level of entrepreneurial and innovation culture attributable to gender. The F-value was 0.237 at a statistical significance level of 0.627, which is greater than the required significance level ($\alpha = 0.05$). The effect size was 0.001, a very small effect size, indicating that gender does not significantly explain the variation in the levels of entrepreneurship and innovation culture among students. This result is consistent with the results of the multiple analyses in Table 3, which showed similar levels of entrepreneurial culture between males and females.

Concerning the college type variable, the results showed statistically significant differences in the levels of entrepreneurial and innovation culture attributable to the college type. The F-value was 9.911 at a significance level of 0.002, which is statistically significant. Referring to the means in Table 2, these differences favored students in science colleges, who achieved a higher mean score (2.77) compared to students in humanities colleges (2.65). The effect size was $\eta^2 = 0.021$, a small effect size, indicating that college type contributes to explaining only a limited proportion of the variance in the levels of entrepreneurship and innovation culture for students. Regarding the academic year variable, the results indicated statistically significant differences in the level of entrepreneurial and innovation culture attributable to academic year. The F-value was 13.662 at a significance level of $p < 0.001$. The effect size was $\eta^2 = 0.083$, which is close to the mean according to Cohen's criteria, indicating that academic year is one of the most influential variables on the levels of entrepreneurial and innovation culture among students. Based on the arithmetic means in Table 2, fourth-year students recorded the highest mean (2.88), followed by third-year students (2.72), then first-year students (2.69), while second-year students scored the lowest (2.56). This result suggests that progress in university studies and the accompanying accumulation of academic and practical experience contribute to strengthening the culture of entrepreneurship and innovation and understanding its role in achieving the SDGs.

Table 5. Scheffe's post-hoc comparisons

Domains	Categories	M	1st	2nd	3rd	4th
Awareness of the concepts of entrepreneurship, innovation, and sustainable development	1st	2.71				
	2nd	2.52	.19			
	3rd	2.93	.22	.41		
	4th	3.01	*.30	*.48	.08	
Attitudes towards entrepreneurship and innovation	1st	2.81				
	2nd	2.70	.10			
	3rd	2.80	.01	.10		
	4th	2.93	*.12	*.22	.13	
Contribution of a culture of entrepreneurship and innovation to achieving the SDGs	1st	2.69				
	2nd	2.54	.15			
	3rd	2.65	.05	.10		
	4th	2.93	*.24	*.39	.29	
Total	1st	2.69				
	2nd	2.56	.13			
	3rd	2.72	.03	.16		
	4th	2.88	*.20	*.32	.16	

* Significant at the 0.05 level.

The results in Table 5 show that the results showed statistically significant differences between fourth-year and first-year students (0.20) and between fourth-year and second-year students (0.32). All these differences favored fourth-year students. No statistically significant differences were found between fourth-year and third-year students or between students in any other academic year.

In the domain of awareness of entrepreneurship, innovation, and sustainable development concepts, the results showed statistically significant differences between fourth-year and first-year students, with a difference of (0.30) favoring the fourth-year students. Similarly, differences were found between fourth-year and second-year students, with a difference of (0.48) favoring the fourth-year students. In contrast, no statistically significant differences were found in the other comparisons. This result indicates that students in advanced academic years possess a higher level of awareness of entrepreneurial and developmental concepts compared to students in the early stages of university studies. This can be explained by the accumulation of knowledge and academic experience with each year of study.

Regarding attitudes towards entrepreneurship and innovation, the results showed statistically significant differences between fourth-year students and both first- and second-year students, with differences of 0.12 and 0.22 respectively, all favoring fourth-year students. No statistically significant differences were found between fourth-year and third-year students, or between students in other academic years. This reflects the development of positive attitudes towards entrepreneurship and innovation as students' progress through their studies and gain more academic and practical experience.

Concerning the contribution of entrepreneurship and innovation culture to achieving the SDGs, the results revealed statistically significant differences between fourth-year and first-year students (0.24) and between fourth-year and second-year students (0.39). In both cases, the differences favored fourth-year students. The remaining comparisons did not reach statistical significance. This finding indicates that students' understanding of the relationship between

entrepreneurship and sustainable development increases gradually with their academic progress.

Discussion

The study results showed that the level of entrepreneurial and innovation culture in achieving the SDGs among private university students in northern Jordan was moderate overall. This indicates that students possess an acceptable level of awareness, knowledge, and attitudes related to entrepreneurship, innovation, and sustainable development. However, this level did not reach the high degree that would reflect a fully established entrepreneurial culture within the university environment. This result can be explained by the expansion that Jordanian higher education institutions have witnessed in recent years in integrating entrepreneurship and innovation concepts into curricula and extracurricular activities. This integration came in response to global trends calling for strengthening the role of universities in achieving the SDGs. Nevertheless, this focus still appears to be more concentrated on the cognitive and awareness-raising aspects compared to the practical aspects that would allow students to engage in entrepreneurial activities. This result is consistent with the findings of Hammouri and Al Bataineh (2024) and Al-Anazi (2025), which indicated that entrepreneurial culture among university students in the Arab world remains at moderate levels despite increasing institutional interest in it. This result can be theoretically explained by the theory of planned behavior (Ajzen, 1991), which posits that knowledge and positive attitudes are prerequisites for the formation of behavioral intentions. However, the transformation of these intentions into actual behavior requires a supportive environment and genuine opportunities for practice, which explains why entrepreneurial culture remains at a moderate level.

The results also showed that attitudes toward entrepreneurship and innovation ranked first among the study areas. This reflects students' positive attitudes toward entrepreneurship and their awareness of its importance in achieving professional success and contributing to economic and social development. This result can be explained by the noticeable expansion of educational and media discourse supporting entrepreneurship, and the increasing number of national and regional initiatives aimed at supporting young entrepreneurs and disseminating success stories in this field. This finding is consistent with the studies by Faqihi and Alababna (2022) and Al-Hassan and Al-Dajani (2022), which indicated a rise in entrepreneurial attitudes and intentions among university students. From the perspective of planned behavior theory, positive attitudes are a key determinant of behavioral intention. Ajzen (1991) argues that individuals who view entrepreneurial behavior positively are more willing to adopt it in the future. This suggests that the university environment has contributed to the formation of attitudes supportive of entrepreneurship, even if these attitudes are not fully reflected in actual practice.

Conversely, the domain of entrepreneurial practices and participation ranked last among the four areas. This result reveals a gap between knowledge and attitudes on the one hand, and actual entrepreneurial behavior on the other. This result can be explained by the limited opportunities available to students for direct participation in entrepreneurial projects. There is also a lack of utilization of incubators, accelerators, and student-focused funding programs, and the continued dominance of traditional employment culture in some social environments. This finding aligns with the observations of Galvão et al. (2020) and Bischoff et al. (2018), who indicated that the success of entrepreneurial education is not measured solely by the acquisition of knowledge, but also by its ability to provide real-world, practical experiences that enable students to engage in entrepreneurial activities and gain hands-on experience. It also supports the findings of Elmobayed (2022), who confirmed that entrepreneurial education fosters entrepreneurial intentions. However, translating these intentions into actual practices requires institutional support and a stimulating learning environment. This result directly supports the assumptions of planned behavior theory. It indicates that positive attitudes alone are not enough

to produce entrepreneurial behavior, unless this is coupled with a high awareness of the ability to implement and the availability of supportive conditions that enable students to turn their ideas into real initiatives and projects.

The results also showed no statistically significant differences attributable to gender in the overall score or sub-domains. This result indicates that opportunities for exposure to educational experiences and activities related to entrepreneurship and innovation have become similar between males and females in the Jordanian university environment. The result can be explained by the notable development in higher education policies that support equal opportunities and women's empowerment, in addition to the expansion of female participation in academic programs and entrepreneurial activities. The current result is consistent with the study by Hammouri and Al Bataineh (2024). It also aligns with recent literature indicating a decline in the importance of traditional demographic variables in explaining entrepreneurial behavior, compared to the increasing influence of educational and institutional factors. From the perspective of planned behavior theory, the similarity in entrepreneurial culture levels between males and females suggests a convergence in the levels of attitudes, perceived behavioral control, and educational opportunities available to both genders within the university environment.

In addition, the results revealed statistically significant differences favoring science students compared to humanities students across all areas and in overall scores. This result can be explained by the nature of academic programs in science colleges, which place greater emphasis on scientific research, innovation, problem-solving, and technological applications. These elements are directly linked to entrepreneurship and innovation. Furthermore, students in these colleges often have greater opportunities to participate in applied projects, scientific competitions, and innovation support programs. This finding aligns with the results of Makai and Dóry (2023), which emphasized the importance of a supportive university environment in shaping an entrepreneurial culture. It also supports the findings of Hojeij (2024), which demonstrated that collaboration between universities and the productive sectors enhances students' entrepreneurial and innovative capabilities. Theoretically, the result can be explained by the fact that the educational environment in science colleges provides higher levels of experience and supportive resources. Consequently, this environment enhances students' awareness of their ability to carry out entrepreneurial activities, which is a fundamental component of the theory of planned behavior.

The results showed statistically significant differences attributable to academic year. These differences favored fourth-year students compared to first- and second-year students. This finding indicates that entrepreneurship and innovation culture develop gradually with the accumulation of educational and academic experiences students gain throughout their university studies. As students progress through their studies, their exposure to specialized courses, practical training, applied projects, and activities related to entrepreneurship and innovation increases. This knowledge enhances their awareness, attitudes, and understanding of the role of entrepreneurship in achieving sustainable development. This result aligns with the findings of Leal Filho et al. (2025) and Planck et al. (2024), who asserted that developing entrepreneurial and sustainable competencies is a cumulative process dependent on successive educational experiences. It can also be explained within the framework of planned behavior theory through the concept of perceived behavioral control. The accumulation of experiences and knowledge leads to increased students' confidence in their ability to carry out entrepreneurial activities. This increase is reflected in higher levels of entrepreneurial culture among students in their later years.

Conclusion

In light of the study's findings, it can be concluded that the level of entrepreneurial and innovation culture in achieving the SDGs among private university students in northern Jordan

is moderate. This result indicates the presence of a knowledge base and positive attitudes toward entrepreneurship and innovation among students. However, this culture still requires further development and strengthening to reach higher levels of effectiveness and impact.

These findings carry important theoretical implications. They provide further support for the validity of planned behavior theory in explaining entrepreneurial culture within the context of Arab higher education. They confirm that the formation of an entrepreneurship and innovation culture depends not only on knowledge or attitudes but is also influenced by the educational environment, academic experiences, and practical opportunities available to students. In addition, the study contributes to expanding the literature on sustainable entrepreneurship by linking entrepreneurial culture to SDGs in an Arab context that remains underrepresented in international literature.

On a practical level, the findings indicate the need for universities to shift their focus from disseminating knowledge and positive attitudes toward entrepreneurship to providing more supportive learning environments for practical application through expanding internship programs. The role of incubators and accelerators should also be strengthened, and greater opportunities should be provided for students to participate in entrepreneurial and innovative projects related to real development challenges. These measures will contribute to transforming entrepreneurial culture from a theoretical and attitudinal framework into a practical behavior. This behavior will support the achievement of SDGs and enhance the role of universities in building an entrepreneurial and innovative human capital capable of meeting future challenges. The findings and generalizability of this study are limited by a set of methodological and procedural constraints. The study focused on investigating the levels of entrepreneurial and innovation culture in achieving the SDGs among private university students in northern Jordan. It also revealed differences in this level based on gender, college type, and year of study. The study population was limited to undergraduate students enrolled in private universities in northern Jordan.

Data was collected during the second semester of the 2025/2026 academic year. Methodologically, the study employed a descriptive survey approach, using a questionnaire as the primary data collection and analysis tool. Therefore, the generalizability of the study's findings should be considered within these limitations, bearing in mind that the accuracy and generalizability of the results are influenced by the characteristics of the research instrument and its levels of validity and reliability. They are also affected by the objectivity and seriousness of the participants in responding to the questionnaire items. In addition, the study was limited to a sample of students from private universities in northern Jordan, excluding other higher education institutions in Jordan.

The study recommends that researchers and those interested in entrepreneurship and sustainable development conduct further studies examining the factors influencing entrepreneurial culture among university students, particularly those factors that limit participation and actual entrepreneurial practice. It also recommends conducting comparative studies between public and private universities, and between different Arab countries.

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Appendix 1. Tool of the study

Domain	N	Item	SDGs	Scale				
				St. agree	Agree	Neutral	Disagree	St. disagree
First domain: Awareness of the concepts of entrepreneurship, innovation and sustainable development	1	I have sufficient knowledge of the concept of entrepreneurship and its importance in society.	8, 4 9					
	2	I recognize the link between innovation and achieving sustainable development.	9, 4					
	3	I am aware of the importance of entrepreneurial projects in reducing youth unemployment.	8					
	4	I have knowledge of SDGs and their role in improving quality of life.	4					
	5	I recognize the importance of freelancing as a future career option.	8					
	6	I can distinguish between a traditional project and an innovative entrepreneurial project.	9, 4					
	7	I am aware of the importance of employing technology and innovation in solving societal problems.	9					
	8	I have knowledge of the entrepreneurial opportunities available in the local environment.	9, 8					

The second domain: Attitudes towards entrepreneurship and innovation	9	I prefer to start my own business in the future rather than wait for a traditional job.	8					
	10	I am excited about participating in entrepreneurial and innovative activities.	8 ,4					
	11	I am excited about participating in entrepreneurial and innovative activities.	9 ,8					
	12	I have the desire to turn my ideas into actionable projects.	9 ,8					
	13	I accept the challenges and calculated risks associated with entrepreneurship.	8					
	14	I believe that entrepreneurship is an effective way to achieve economic independence.	8					
	15	I make sure to look for creative solutions to the problems I face.	9 ,4					
	16	I believe that university students are capable of contributing to achieving sustainable development through entrepreneurial projects.	8 ,4 9					
Third domain: Entrepreneurial practices and participation	17	I participate in activities or events related to entrepreneurship and innovation.	8 ,4 9					
	18	I have previously participated in courses or workshops specializing in entrepreneurship	4					
	19	I follow the pioneering initiatives and programs organized by the university or various institutions.	8 ,4 9					
	20	I work on developing ideas or projects of an entrepreneurial or innovative nature.	9					
	21	I utilize digital resources and online platforms related to entrepreneurship.	9 ,4					

	22	I participate in competitions, exhibitions, or entrepreneurial forums when available.	8, 4 9					
	23	I seek to form work teams to implement innovative ideas or projects.	9					
	24	I look for investment or development opportunities that can be developed through entrepreneurial projects.	9, 4					
Fourth domain: The contribution of entrepreneurship and innovation culture to achieving the SDGs	25	A culture of entrepreneurship contributes to enhancing self-employment opportunities for young people.	8					
	26	Entrepreneurial projects help reduce unemployment problems in society.	8					
	27	Innovation contributes to improving the quality of services provided to the community.	9					
	28	Entrepreneurship supports economic growth and improves living standards.	8					
	29	Entrepreneurial projects contribute to addressing some social and environmental issues.	9					
	30	An entrepreneurial culture helps develop social responsibility among young people.	4					
	31	Innovation enhances the ability to find sustainable solutions to future challenges.	9					
	32	Entrepreneurial projects contribute to supporting the knowledge-based economy.	9					
	33	Entrepreneurship helps to boost competitiveness and productivity in society.	8					

	34	A culture of entrepreneurship and innovation is a key requirement for achieving the SDGs.	‘8 ‘4 9					
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