EFFECT OF UNIVERSITY UNDERGRADUATE EDUCATION ON STUDENTS' ENTREPRENEURSHIP SPIRIT, CASE STUDY: GERMAN UNIVERSITY OF TECHNOLOGY IN OMAN

Mehdi A Kamran, Urmia University of Technology
Samira Afsharfar, German University of Technology
Al Ghaliya Al Shukaili, German University of Technology
Asma Al Shaqsi, German University of Technology

ABSTRACT

In today's world of change, countries feel the need to develop entrepreneurship more than ever, and universities are the perfect place for knowledge-based innovation. Therefore, in this study, the impact of undergraduate education on students' entrepreneurial spirit is explored. For this purpose, the research population consists of undergraduate students at the German University of Technology in different disciplines over four consecutive years, between 2018 and 2021. Research data is collected through questionnaires distributed to the target population. Stratified random sampling strategy is used to select participants from the target population, and the sample size was decided based on Cochran's formula for a finite population, which is 748 students in total. Data is analyzed using independent sample t-test and one-way Analysis of Variance. The results show that there is a significant difference between the entrepreneurial spirit of the students of Logistics and International Business and Services Management in Year 1 and in Years 3 and 4, but there is not a significant difference between the entrepreneurial spirit of the students of Process, Mechanical, and Environmental Engineering in Year 1 and in Years 3 and 4.

Keywords: Entrepreneurial SPIRIT, University Education, Field of Study (Discipline), t-Independent Test, ANOVA.

INTRODUCTION

Entrepreneurship is the process of creating value through the creation of a unique collection of resources to benefit from the opportunities Ahmadpour Daryani (1999) and it is creating initiatives, innovations and establishing new businesses (Saber 2002; Parsa et al., 2011). The current era, with its rapid and continuous change and transformation, has created a variety of needs that necessitate up-to-date skills, and those who acquire knowledge beyond the confines of their area of expertise will perform better in solving practical problems and have a competitive advantage over others Talebi & Zare Yekta (2008). This additional expertise and competitive advantage will assist and accompany the graduates in developing their resilience and independence, particularly in this new post-COVID-19 environment, and in fostering a risk-tolerant disposition, which is essential for initiating initiatives, developing new products, and launching new businesses (Agarwal & Prasad, 1998; Malekpour Lapari & Delavar, 2016; Hardie et al., 2020). The outcome of these situations has resulted in the necessity of development of

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

entrepreneurial capabilities in countries in order to create new businesses, use of unused capacities, develop existing capacities and solve social problems. As a response to these challenges, the new mission of universities is to create and improve the entrepreneurial abilities in students (Yadollahi Farsi, 2007). In fact, universities may increase student entrepreneurship by fostering entrepreneurial traits such as the need for achievement, locus of control, inclination for risk-taking, tolerance for uncertainty, innovativeness, and self-confidence (Gurol & Atson, 2006; Rahai (2007). Referring to the available information about the curricula of leading universities in entrepreneurship in developed and developing countries, the importance of education and research system in the evolution of entrepreneurship is determined Aldrich & Martinez (2001). Nowadays in many countries, entrepreneurship training courses based on the information and communication technology, not only opened up its place in the curriculum of different educational levels, from elementary to high school, but also in different academic fields (Alderich et al., 2001). The main goal of entrepreneurship education, establishment, and management of business enterprises in educational centers are that learners acquire self-confidence and capacity of self-declaration, in such a way that they could be able to apply their knowledge in practice and learn how to identify and exploit opportunities and cooperate with each other (Ranjbarian, 2014). In line with this global movement, universities in Oman can also provide students with scholarly and specialized education by designing graduate and postgraduate courses or designing entrepreneurship courses in all disciplines to develop entrepreneurial and management skills in their graduates. Overall, the purpose of this study is to determine the effect of university undergraduate education on students' entrepreneurship spirit. The research population consists of undergraduate students at the German University of Technology (GUtech) in five different disciplines of Logistics (LOG), International Business and Service Management (IBSM), Process Engineering (PE), Mechanical Engineering (ME), and Environmental Engineering (EE) over four consecutive years, between 2018 and 2021. In this regard, the following research questions are explored.

Question 1: Is there a significant difference between entrepreneurial spirit score of undergraduate students of LOG, IBSM, PE, ME, and EE at the entrance?

Question 2: Is there a significant difference between the entrepreneurial spirit of the students in LOG, IBSM, PE, ME, and EE students in their last years of undergraduate education (Year 3 and 4)?

Question 3: Is there a significant difference between entrepreneurial spirit score of undergraduate students of LOG in Year 1 and in Years 3 and 4?

Question 4: Is there a significant difference between entrepreneurial spirit score of undergraduate students of IBSM in Year 1 and in Years 3 and 4?

Question 5: Is there a significant difference between entrepreneurial spirit score of undergraduate students of PE in Year 1 and in Years 3 and 4?

Question 6: Is there a significant difference between entrepreneurial spirit score of undergraduate students of ME in Year 1 and in Years 3 and 4?

Question 7: Is there a significant difference between entrepreneurial spirit score of undergraduate students of EE in Year 1 and in Years 3 and 4?

RESEARCH HISTORY

In the following, some research on entrepreneurship in universities are surveyed.

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

Postigo (2002) conducted research on evaluating and assessing the current state of entrepreneurship training in Argentina in terms of students' entrepreneurial ability. He demonstrated that, according to students, Introduction to Entrepreneurship and Business, Creativity and Innovation, Social Entrepreneurship, Financial Affairs and Investment, Business Plan Preparation, and Management of Business Units are the courses that enhance students' entrepreneurship skills the most. Galloway et al. (2005) discovered in a study of 519 students from four Scottish universities that entrepreneurship education is effective in enhancing students' creativity, teamwork, self-confidence, communication, and management skills. Badri et al. (2006) concluded that there is a significant difference between the entrepreneurial abilities of university freshmen and seniors. However, there is no discernible difference between the entrepreneurial abilities of students who visit the entrepreneurship center and those of other students. Mohseni et al. (2013) conducted research on the role of entrepreneurship training in the entrepreneurial attitudes and general self-esteem beliefs of students. Case research was conducted by Shahid Beheshti University students. Students' entrepreneurial attitudes and general self-efficacy beliefs are positively affected by entrepreneurship education, and there is a significant relationship between entrepreneurial attitudes and general self-efficacy. Vatankhah & Rezaei Moghaddam (2015) investigated the entrepreneurial spirit of undergraduate students through their research. The undergraduate students at the Faculty of Agriculture at Shiraz University comprised the study population, and stratified random sampling was used as the sampling technique. The results indicated that there is a significant difference between "*student cooperative*" members and non-members in terms of entrepreneurial spirit mean variables. The average risk-taking and inventiveness of members is higher than that of non-members. Moreover, the average creativity of students who have taken entrepreneurship courses is higher than that of those who have not. Abdulrasheed et al. (2019) assessed the impact of entrepreneurship course on entrepreneurial intention among undergraduate students of Al-Hikmah University, Kwara State, Nigeria. They sampled 338 students out of 2800 students and a questionnaire was used to elicit data from the respondents. The results showed that entrepreneurship course significantly impacts student's knowledge and their entrepreneurial intention to a start-up business. It is also concluded that poor state of infrastructure and lack of fund have a significant adverse effect on student entrepreneurship intention.

In contrast to the findings of some earlier studies, Sookhtanlo et al. (2009) demonstrated that the level of entrepreneurial ability of students majoring in Agricultural Engineering does not increase as they progress through higher education. Moreover, the lack of sufficient incentives for students to engage in entrepreneurship and the absence of accurate and comprehensive entrepreneurial education prevent the development of an entrepreneurial mindset among students. Ahmadi (2006) demonstrated that the Electrical Engineering curriculum does not adequately equip students and graduates with the necessary entrepreneurial knowledge and skills. Even students with a strong entrepreneurial spirit are not prepared to launch a business on their own after graduation. Malekpour Lapari & Delavar (2016) examined the effect of university education on the development of an entrepreneurial mindset among Allameh Tabatabai University students. This study employed a quantitative-qualitative research approach. The qualitative approach consisted of analyzing, documenting, observing, and interviewing faculty members, while the quantitative approach utilized a questionnaire created by the researcher. The compilation concludes that Allameh Tabatabai University's university education has no effect on fostering the entrepreneurial spirit of its students, and that the university should devote more resources to advancing entrepreneurship as a mission of universities. Hardie et al. (2020)

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

reviewed of entrepreneurship education pedagogy in 45 studies across nine countries to understand the effectiveness of programs that supports the students in seizing the entrepreneurial opportunities arisen in their communities. He concluded that at the schooling level these kinds of trainings are not significantly affecting, and they should be followed seriously with experimental and practical aspects and even sustained during the university level Su et al. (2021).

In a non-academic environment, Nieman (2001) focused on the training of entrepreneurs and small business experts in South Africa. His investigation revealed that small business founders place greater emphasis on management than on entrepreneurial education. Moghtadaie & Jamshidian (2021) surveyed the impact of entrepreneurship education on entrepreneurial attitude, ability, and aspiration of rural women. They conducted a quasi-experimental longitudinal study. The results revealed that entrepreneurial aspiration, attitude, and ability considerably increased on the post-test.

Contreras et al. (2020) conducted a longitudinal study to determine if a novel art-based entrepreneurship program influences the entrepreneurial intention of a sample of business students at a university in Colombia, South America. The results showed that the program is positively influencing entrepreneurial intention among students, mainly the females. Indriyani et al. (2020) investigated entrepreneurial spirit among Indonesian university students. They obtained the data from a Surabaya private university with a management study program. A questionnaire-based accreditation with a total of seven private universities. Using SPSS, 130 completed questionnaires were analyzed. According to the results, entrepreneurial creativity and entrepreneurial mindset have substantial positive effects on entrepreneurial spirit. Su et al. (2021) extended the theory of planned behavior framework by coupling it with perceived university support and explained the effect of such support on student entrepreneurial intention. The results proved universities' critical role in establishing entrepreneurial spirit in students. Moreover, the results showed a significant impact on behavioral control for perceived university support. The impact of perceived university support on attitude toward entrepreneurship was far greater than behavioral control. Therefore, overall, they concluded that engaging in continuous process of entrepreneurship (like through entrepreneurship courses) can benefit economic and social development.

Passaro et al. (2021) focused on the university academics instead of the students. They studied whether and how entrepreneurial education provided by a university business plan competition affects the entrepreneurial intention among academics. They proposed a theoretical model to elicit the relationships. A structural equation was used to test the model on academics of seven Italian universities. The results depicted that entrepreneurial education influences both entrepreneurship-related human capital and entrepreneurial intention.

Colman et al. (2021) investigated the impact of perceived innovativeness, risk, and educational support on the students' entrepreneurial intentions of University of Cape Town, Africa. SmartPLS software is used to analyze the data that is collected via an online questionnaire. In a similar study, Tuffour & Bunyaminu (2022) examined the factors influencing entrepreneurship education effectiveness in Ghanaian Technical Universities. Five factors of Financial Adequacy, Infrastructure Readiness, Human Resource Adequacy, Government Support and Student Readiness are influential.

Mirriam (2022), in a similar approach to our work, examined the impact and effectiveness of undergraduate university education in the same university but different disciplines. Stratified random sampling technique was used to select 220 graduates. The research concluded that a vibrant industrial liaison office to facilitate the proper filtering of the graduates

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

to the market can be of significant help as the results showed a weak relation between the existence of the entrepreneurship education and employment status.

Olafisan & Adebisi (2022) examined strategies to promote entrepreneurial awareness among students in a university in Nigeria. Data was collected from 1,920 students who were selected randomly via a questionnaire. The results indicated that reasonable entrepreneurial awareness exists among the students. They showed that strategies like inclusion of entrepreneurship in school curriculum, improving team-working, personal maturity, and critical-thinking skills can promote entrepreneurial awareness among the undergraduates Gürol & Atsan (2006).

Kolapo et al. (2023) focused on graduate students and not undergraduate ones. They assessed the Influence of attitudes and behaviors on business students' entrepreneurial intention. Data was collected from 129 MBA and Master of Management students from a university in South Africa. The results revealed that entrepreneurial intention is positively correlated to the attitudes and perceived behaviors of the students. They concluded that enhancing the degree of attitude towards behavior and perceived behavior can enhance entrepreneurial intention among the business students.

HYPOTHESES

In this research, seven hypotheses are posited. The list of null hypotheses examined is as follows.

H_1: *There is not a significant difference between the entrepreneurial spirit of the students of LOG, IBSM, PE, ME, and EE at the entrance (when they are in the first year).*

H_2: *There is not a significant difference between the entrepreneurial spirit of the students of LOG, IBSM, PE, ME, and EE students in their last years of undergraduate education.*

H_3: *There is not a significant difference between the entrepreneurial spirit of the students of LOG in Year 1 and in Years 3 and 4.*

H_4: *There is not a significant difference between the entrepreneurial spirit of the students of IBSM in Year 1 and in Years 3 and 4.*

H_5: *There is not a significant difference between the entrepreneurial spirit of the students of PE in Year 1 and in Years 3 and 4.*

H_6: *There is not a significant difference between the entrepreneurial spirit of the students of ME in Year 1 and in Years 3 and 4.*

H_7: *There is not a significant difference between the entrepreneurial spirit of the students of EE in Year 1 and in Years 3 and 4.*

REASERCH METHODOLOGY

The present research is an analytical and quantitative study in terms of type and method. Statistical population of the research consists of the undergraduate students at German University of Technology (GUtech) who entered the university from 2018 to 2021 in the study programs of Logistics (LOG), International Business and Service Management (IBSM), Process Engineering (PE), Mechanical Engineering (ME), and Environmental Engineering (EE). Stratified random sampling strategy is used to select participants from this population and the sample size was decided based on Cochran's formula for a finite population, which is 748 students in total. Research variables including independent and dependent variables are as follows: Independent

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

variables are (I) disciplines of LOG, IBSM, PE, ME, and EE at GUtech and (II) years spent studying in undergraduate education at university (freshman, sophomore, junior, and senior) during the period of 2018 to 2021; and dependent variable is entrepreneurial spirit score.

In order to carry out the survey, identification criteria of which are introduced in Kordnaij et al. (2007) is used where entrepreneurial characteristics is consists of five identification criteria of Risk-taking, Internal control, Achievement Motivation, Independence, and Creativity. Please notice that, henceforth, the terms entrepreneurial spirit, entrepreneurial characteristics, and entrepreneurial capability are applied interchangeably. The validity of the questionnaire of measuring the entrepreneurial spirit that is used in this study is investigated and proved in (Kordnaij et al., 2007). Cronbach's alpha measure is used to examine the reliability of the questionnaire where 0.92 shows the questionnaire is quite reliable (Kordnaij et al., 2007).

The Shapiro-Wilk and Kolmogorov-Smirnov tests are utilized to examine the normality of the data, whereas the t-independent test and One-Way Analysis Of Variance (ANOVA) are utilized to evaluate and test questions and hypotheses. The SPSS software is utilized as the testing platform.

DATA ANALYSIS

The respondents to the questionnaire are 239 Log students, 179 IBSM, 169 PE, 83 ME and 78 EE students that 98% of them are between 18 and 23 years old. Our sample consists of 169 male (23%) and 579 female (77%) students.

Data Scoring Results (calculation of norms)

To be able to interpret and explain each person's capability, and compare them with each other, it is necessary to score them through a general scale (Sharif et al., 2021). The purpose of this scale/norm is to express the relative status and rank of an individual in a reference group. An appropriate reference group is a group that a person can logically compare with it Hooman (2002). Table 1 shows the status of each person for each of the attributes/criteria in a four-category classification of very weak to very strong. According to the table, all five criteria, as well as the overall scale entrepreneurial spirit has classified in a continuum from very weak to very strong Kordnaij et al. (2007).

Table 1
NORMS OF DIFFERENT ENTREPRENEURIAL SPIRIT ATTRIBUTES/CRITERIA ACCORDING TO FOUR CATEGORIES OF VERY WEAK TO VERY STRONG

Criteria	Very Weak	Weak	Strong	Very Strong
Risk-taking	18-43	43-51	51-57	57-72
Internal control	17-49	49-55	55-60	60-68
Achievement Motivation	15-44	44-48	48-53	53-60
Independence	8-25	25-28	28-30	30-32
Creativity	7-19	19-21	21-23	23-28
Entrepreneurial spirit	65-180	181-203	204-223	224-260

Similarly, Tables 2 and 3 show the status of case study students in LOG, IBSM, PE, ME, and EE of GUtech. They have been categorized according to the year of spending at the university, and their entrepreneurial spirit scores have been calculated Zali (2006).

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

Table 2 ENTREPRENEURIAL SPIRIT OF LOG AND IBSM STUDENTS				
	LOG		**IBSM**	
Year	1	3&4	1	3&4
Number of Sample	101	138	102	77
Score	196.82	205.87	197.07	204.43
	Weak	Strong	Weak	Strong

Table 3 ENTREPRENEURIAL SPIRIT OF PE, ME, & EE STUDENTS						
	PE		ME		EE	
Year	1	3&4	1	3&4	1	3&4
Number of Sample	64	104	31	52	24	55
Score	197.73	195.26	199.39	197.25	198.17	197.33
	Weak	Weak	Weak	Weak	Weak	Weak

It can be seen from Table 2 that LOG students are "*weak*" in terms of entrepreneurial spirit (196.82) when they enter the university in Year 1. But their entrepreneurial spirit score improves to "*strong*" (205.87) when they are in last years of their education (Year 3 & 4). Similarly, IBSM students, who are in Year 1, scores 197.07, which is a weak entrepreneurial spirit, and their score increases to 204.43, which is a strong entrepreneurial spirit when they are in Years 3 and 4 Table 2. In contrast to LOG and IBSM students, Year 1 PE, ME, and EE students are weak according to their entrepreneurial spirit score, 197.73, 199.39, 198.17, respectively, and still, they are weak in this regard, 195.26, 197.25, 197.33, respectively, when they are in Years 3 and 4 Table 3.

Normally Distributed Data

Before conducting any test, which is based on the assumption of normally distributed data, a normality test must be applied. Both tests applied in this research, t-independent test and one-way ANOVA are dependent on assumption of the normally distributed data in the statistical society. Therefore, this assumption is examined through three steps. In the first step, the histograms of the data, which are related to each quadruple entrance in five disciplines of LOG, IBSM, PE, ME, and EE are drawn to see if it is similar to the bell-shaped normal distribution. In the second step, the amount of Skewness and Kurtosis measures of data are measured to check whether those values are close to the desired values of a normal distribution (between -2 and 2). Finally, in the third step, two Shapiro-Wilk and Kolmogorov-Smirnov tests are applied to verify the more accurate examination of the normally-distribution of the data.

Testing the Questions and Research Hypotheses

After ensuring that the applied data are normally distributed, and calculating the norms associated with each variable (Tables 1-3), in this part of the study, the main question of the research that is the impact of university undergraduate education on entrepreneurial spirit of students, and the hypotheses are investigated. There is a fact that students usually enter the university with common and basic theoretical fields (for example, the students who are admitted to an industrial/technology-based university should have received specific education in mathematics-physics fields in high school and pre-university level). Therefore, they almost enter the university with equal capabilities, particularly, entrepreneurship capabilities. In other words, except for highly talented/gifted students, others have the same entrepreneurial capabilities at the

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

time entering the university. This assumption must be tested before being used. In Question 1, such an assumption is tested by 1W-ANOVA and the entrepreneurial spirit score of LOG, IBSM, PE, ME, and EE students are compared at the time entering the university.

Question 1: Is there a significant difference between entrepreneurial spirit score of undergraduate students of LOG, IBSM, PE, ME, and EE at the entrance?

Null H_1 *:There is no significant difference between the entrepreneurial spirit of the students of LOG, IBSM, PE, ME, and EE at the entrance (when they are in the first*

This test is carried out on the basis of data collected from LOG, IBSM, PE, ME, and EE at GUtech students who are in their first year of their period. According to the test results reported in Table 4, the value of Sig. (*p*-value) of the test is 0.967 which is more than 0.05, thus, the null hypothesis is accepted, or, more precisely, there is not enough evidence to reject the null hypothesis.

Table 4
RESULTS OF 1W-ANOVA FOR ALL LOG, IBSM, PE, ME, EE DISCIPLINES IN YEAR 1

Entrepreneur	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	188.373	4	47.093	0.140	0.967
Within Groups	106422.484	317	335.718		
Total	106610.857	321			

The results of Table 4 also support the idea of using Student's t-independent test to compare the entrepreneurial spirit scores of students in Years 3 and 4 with the ones of students in Year 1. In other words, instead of checking and comparing the entrepreneurial spirit scores of same students at the time entering and leaving the university by using Student's t-dependent test, we compare the entrepreneurial spirit scores of freshmen as a proxy for students of Years 3 and 4 when they were freshmen.

In the following, in order to investigate the main question of the research which is whether "*academic undergraduate education*" in various fields of study, impact on the entrepreneurial spirit of students or not, different questions are designed to be examined.

Question 2: Is there a significant difference between the entrepreneurial spirit of the students in LOG, IBSM, PE, ME, and EE students in their last years of undergraduate education (Year 3 and 4)?

In the same way to the previous part, to answer the question, first, the question is stated through hypothesis.

Null H_2 *There is not a significant difference between the entrepreneurial spirit of the students of LOG, IBSM, PE, ME, and EE students in their last years of undergraduate education.*

Similar to the previous question and hypothesis, 1W-ANOVA and the entrepreneurial spirit score of LOG, IBSM, PE, ME, and EE students are compared in their last years of undergraduate education. As it is can be seen from the results, reported in Table 5, the value of Sig. for the mentioned data is 0.000 which is less than 0.05. Therefore, according to the test results, it is concluded that the null hypothesis is rejected with %95 of confidence, thus, there is a significant difference between the entrepreneurial spirit of the students of LOG, IBSM, PE, ME, and EE students in their last years of undergraduate education Yaddollahi Farsi (2007).

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

Table 5
RESULTS OF 1W-ANOVA FOR ALL LOG, IBSM, PE, ME, EE DISCIPLINES IN YEARS 3 & 4

Entrepreneur	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9069.744	4	2267.436	6.935	0.000
Within Groups	137656.359	421	326.975		
Total	146726.103	425			

In the following, the entrepreneurial spirit score of undergraduate students is investigated separately in each discipline. Doing so, t-independent test is applied in each discipline to compare the entrepreneurial spirit score of students at the entrance (Year 1) and in their last years of education (Years 3 & 4).

Question 3: Is there a significant difference between entrepreneurial spirit score of undergraduate students of LOG in Year 1 and in Years 3 and 4?

Null H_3 *There is not a significant difference between the entrepreneurial spirit of the students of LOG in Year 1 and in Years 3 and 4.*

As it is can be seen from the results, reported in Table 6, the value of Sig. for the mentioned data is 0.000 (0.001 in case Equal variances not assumed) which is less than 0.05. Therefore, according to the test results, it can be concluded that the null hypothesis is rejected with %95 of confidence, thus, there is a significant difference between the entrepreneurial spirit of the students of LOG in Year 1 and in Years 3 and 4.

Table 6
RESULTS OF T-INDEPENDENT TEST FOR LOG STUDENTS IN YEAR 1 AND YEARS 3 & 4

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
								Lower	Upper
Equal variances assumed	3.930	0.049	-3.695	237	0.000	-9.048	2.449	-13.872	-4.224
Equal variances not assumed			-3.541	178.345	0.001	-9.048	2.555	-14.090	-4.006

Question 4: Is there a significant difference between entrepreneurial spirit score of undergraduate students of IBSM in Year 1 and in Years 3 and 4?

Null H_4: *There is not a significant difference between the entrepreneurial spirit of the students of IBSM in Year 1 and in Years 3 and 4.*

As it is can be seen from the results, reported in Table 7, the value of Sig. for the mentioned data is 0.007 (0.009 in case Equal variances not assumed) which is less than 0.05. Therefore, according to the test results, it can be concluded that the null hypothesis is rejected with %95 of confidence, thus, there is a significant difference between the entrepreneurial spirit of the students of IBSM in Year 1 and in Years 3 and 4.

Table 7
RESULTS OF STUDENT'S T-INDEPENDENT TEST, YEARS: 1 AND 3&4 (IBSM)

	Levene's Test for Equality of	t-test for Equality of Means

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

	Variances								
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
								Lower	Upper
Equal variances assumed	4.363	0.038	-2.706	177	0.007	-7.360	2.720	-12.727	-1.993
Equal variances not assumed			-2.645	148.107	0.009	-7.360	2.783	-12.859	-1.861

Question 5: Is there a significant difference between entrepreneurial spirit score of undergraduate students of PE in Year 1 and in Years 3 and 4?

Null H_5 *There is not a significant difference between the entrepreneurial spirit of the students of PE in Year 1 and in Years 3 and 4.*

As it is can be seen from the results, reported in Table 8, the value of Sig. for the mentioned data is 0.419 which is more than 0.05. Therefore, according to the test results, it can be concluded that the null hypothesis is accepted with %95 of confidence, thus, there is not a significant difference between the entrepreneurial spirit of the students of PE in Year 1 and in Years 3 and 4.

Table 8
RESULTS OF T-INDEPENDENT TEST FOR PE STUDENTS IN YEAR 1 AND YEARS 3 & 4

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
								Lower	Upper
Equal variances assumed	0.192	0.662	0.810	166	0.419	2.475	3.054	-3.556	8.505
Equal variances not assumed			0.826	141.525	0.410	2.475	2.998	-3.451	8.401

Question 6: Is there a significant difference between entrepreneurial spirit score of undergraduate students of ME in Year 1 and in Years 3 and 4?

Null H_6 *There is not a significant difference between the entrepreneurial spirit of the students of ME in Year 1 and in Years 3 and 4.*

As it is can be seen from the results, reported in Table 9, the value of Sig. for the mentioned data is 0.530 which is more than 0.05. Therefore, according to the test results, it can be concluded that the null hypothesis is accepted with %95 of confidence, thus, there is not a significant difference between the entrepreneurial spirit of the students of ME in Year 1 and in Years 3 and 4.

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

Table 9
RESULTS OF T-INDEPENDENT TEST FOR ME STUDENTS IN YEAR 1 AND YEARS 3 & 4

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
								Lower	Upper
Equal variances assumed	0.152	0.698	0.630	81	0.530	2.137	3.391	-4.611	8.885
Equal variances not assumed			0.619	59.867	0.538	2.137	3.450	-4.764	9.038

Question 7: Is there a significant difference between entrepreneurial spirit score of undergraduate students of EE in Year 1 and in Years 3 and 4?

Null H_7 *There is not a significant difference between the entrepreneurial spirit of the students of EE in Year 1 and in Years 3 and 4.*

As it is can be seen from the results, reported in Table 10, the value of Sig. for the mentioned data is 0.847 which is more than 0.05. Therefore, according to the test results, it can be concluded that the null hypothesis is accepted with %95 of confidence, thus, there is not a significant difference between the entrepreneurial spirit of the students of EE in Year 1 and in Years 3 and 4.

Table 10
RESULTS OF T-INDEPENDENT TEST FOR EE STUDENTS IN YEAR 1 AND YEARS 3 & 4

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
								Lower	Upper
Equal variances assumed	2.815	0.097	0.193	77	0.847	0.839	4.346	-7.815	9.494
Equal variances not assumed			0.230	66.928	0.819	0.839	3.656	-6.458	8.136

DISCUSSION

From the results discussed above, undergraduate education is significantly affecting the students' entrepreneurship spirit in a positive way in some disciplines like Logistics and International Business and Services Management, but in some others (e.g., Process, Mechanical, and Environmental Engineering), not only significantly not affecting the students' entrepreneurship spirit but also in some cases insignificantly declining (Tables 3, Table 8-10). A general review of the designed curriculum in these disciplines shows that in Logistics and International Business and Services Management, some innovation-based, management, and business courses (e.g., "*Entrepreneurship and Innovation*", "*Strategic Management*", etc.) are offered, while this is not the case in Process, Mechanical, and Environmental Engineering. It is

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

worth noting that we are not claiming that these courses are the only reason of this dissimilarity between the disciplines, but most probably, they are influential reasons for such a contrast. Trivially, this issue must be statistically analyzed with details. Especially, when reviewing the literature leads us to similar conflicting results. For example, Nimen (2001), Postage (2002), Galloway et al. (2005), Mohseni et al. (2013), Rezaei Moghaddam (2015), Abdulrasheed et al. (2019), Indriyani et al. (2020), and Su et al. (2021) emphasize on the positive relationship between management and management training on entrepreneurship, but the overall result of Badri et al. (2006), Sookhtanlo et al. (2009), Ahmadi (2006), Malekpour Lapari & Delavar (2016), and Hardie et al. (2020) suggest that university education is not effective in fostering students' entrepreneurial capabilities and should be followed and strengthened with some other inspiring motivators.

Also, it is important to pay attention that students' entrepreneurship spirit can be negatively affected if the program doesn't have proper plan on this important issue.

Moreover, the results show that although the improvements in entrepreneurship criteria (i.e., Risk-taking, Internal control, Achievement Motivation, Independence, and Creativity) of LOG and IBSM students are not extremely high, cumulatively, these improvements have a significant impact on the improvement of student entrepreneurship spirit. At least the same approach can be followed by other disciplines.

SUGGESTIONS

In this study, we investigated the impact of undergraduate education on students' entrepreneurial spirit. In doing so, the students of five disciplines of Logistics, International Business and Services Management, Process Engineering, Mechanical Engineering, and Environmental Engineering in a four-year period of 2018 to 2021 at German University of Technology are considered as a case study. A standard questionnaire distributed over the target population. The normally-distribution of data is examined through different ways of histogram, Skewness and Kurtosis measures, and Shapiro-Wilk and Kolmogorov-Smirnov tests. In order to respond the questions and test the hypotheses of the research, t-independent test and one-way analysis of variance is applied at a 95% of confidence level. The obtained results are expressed in the following sub-section.

CONCLUSION

The results of the study show that:

There is not a significant difference between the entrepreneurial spirit of the students of Logistics, International Business and Services Management, Process Engineering, Mechanical Engineering, and Environmental Engineering at the entrance to the university.

There is a significant difference between the entrepreneurial spirit of the students of Logistics, International Business and Services Management, Process Engineering, Mechanical Engineering, and Environmental Engineering in their last years of undergraduate education. But when digging more about this significant difference, it can be seen that the difference is only lies in Logistics and International Business and Services Management, and not in Process Engineering, Mechanical Engineering, and Environmental Engineering. In another words,

There is a significant difference between the entrepreneurial spirit of the students of Logistics and International Business and Services Management in Year 1 and in Years 3 and 4.

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

There is not a significant difference between the entrepreneurial spirit of the students of Process, Mechanical, and Environmental Engineering in Year 1 and in Years 3 and 4.

RESEARCH SUGGESTION AND IMPLICATIONS

In the following, we recommend some directions for future works and some implications.

It is needed to identify the courses affecting the level of entrepreneurial spirit of students based on their disciplines. This research can be pursued in different ways. It should be investigated which courses and how far they are affecting the student's entrepreneurship spirit. Also, how these courses are affecting not only different criteria of entrepreneurship spirit but also in different gender. Moreover, on a more general level for small and large industry owners, with the aim of increasing their creative power and entrepreneurial spirit. Carrying out research in order to compare different disciplines and universities according to the degree of entrepreneurship of the students can be considered as an interesting option.

Since training of human personality at the younger ages is much more influential, it is suggested that programs to enhance and foster the creativity and entrepreneurial spirit of children, teens, and youth are included in their courses.

According to the results obtained, "*there is no significant difference between the entrepreneurial score of students in the first and last years of their education*" in some other departments. It is proposed that some courses are designed and added to their curriculum to improve students' entrepreneurial capabilities. As articulated by Contreras et al. (2020), the purpose of entrepreneurship education is to empower the individuals' intentions for startups, self-efficacy perseverance and risk acceptance attitudes not just concentrating on "*starting a new job*". Hence, the presence of such characteristics in university graduates is a necessity of today's society, it should be designed and added to all disciplines. This approach could be spread to high school or even earlier educational levels.

ACKNOWLEDGEMENTS

This research was partially funded by TRC Block Funding in Oman (BFP/URG/EHR/21/014).

We would like to also express our sincere gratitude to Dr. Osman Barghouth for his constructive comments.

REFERENCES

Abdulrasheed, J., Suleiman, Y., Bolaji, H.O., Tunbosun, L.A., & Abubakar, Y.A. (2019). Assessing the impact of entrepreneurship course on entrepreneurial intention: A case study of Al-Hikmah University undergraduate students. *Amity Journal of Entrepreneurship*, 4(1), 1-14.

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information systems research*, 9(2), 204-215.

Ahmadi, M. (2006). Needs assessment of Entrepreneurship Training among undergraduate students in Electrical Engineering University of Tehran. *Entrepreneurship Center of Tehran University, Tehran.*

Ahmadpour Daryani, M. (1999). *Entrepreneurship: Definitions, Theories and Patterns. First Edition, Tehran: Pardis Publishing.*

Aldrich, H.E., & Martinez, M.A. (2001*).* Many are called, but few are chosen: An evolutionary perspective for the study of entrepreneurship. *Entrepreneurship Theory and Practice, 25(4), 41-56.*

Badri, E., Liaghatdar, M.J., Abedi, M.R., & Jafari, E. (2006). A survey of entrepreneurship capabilities of Isfahan University students. *Quarterly Journal of Research and Planning in Higher Education, 12(2), 73-90.*

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

Colman, M., Da Silva, J., Westermann, B., & Dlamini, S. (2021). The Factors That Influence The Entrepreneurial Intentions Of University Students. *Journal of Entrepreneurship Education*, *24*(5), 1-17.

Contreras, F., Espinosa, J.C., Cheyne, A., & Pulgarín, S. (2020). Entrepreneurial intention in business students: The impact of an art-based program. *Journal of Entrepreneurship Education*, *23*(6), 1-9.

Galloway, L., Anderson, M., Brown, W., & Wilson, L. (2005). Enterprise skills for the economy. *Education+ Training*.

Gürol, Y., & Atsan, N. (2006). Entrepreneurial characteristics amongst university students: Some insights for entrepreneurship education and training in Turkey. *Education+ training*.

Hardie, B., Highfield, C., & Lee, K. (2020). Entrepreneurship education today for students' unknown futures. *Journal of Pedagogical Research*, *4*(3), 401-417.

Hooman, H. A. (2002). Preparation and standardization of job satisfaction measurement scale. *Tehran: Government education management center*.

Indriyani, R., Darmawan, R.C., & Gougui, A. (2020). Entrepreneurial spirit among university students in Indonesia. In *SHS web of conferences*, 76, 01042.

Kolapo, M.O., Aboluwodi, D., Nomlala, B.C., & latiff, A.A.(2023). The Influence of Attitudes and Behaviours on Business Students' Entrepreneurial Intention In South Africa. *Journal of Entrepreneurship Education, 26(2), 1-14.*

Kordnaij, A., Zali, M.R., Hooman, HA, Shams, S.H. (2007). *Tools for Personality Characteristics Evaluation of Iranian Entrepreneurs. First Edition, Tehran: Tarbiat Modarres University Press.*

Malekpour Lapari, K., Delavar, A. (2016). The identification role of academic training on developing the entrepreneurial spirit and providing solutions strategies for promoting among the students of Allameh Tabataba'I University. *Educational Research Journal, 2(31), 32-57.*

Mirriam, J. (2022). Cross Disciple Graduate Perceptions of the Effectiveness of Entrepreneurship Education in A Turbulent Economy; Case of Chinhoyi University of Technology, Zimbabwe. *Journal of Entrepreneurship Education, 25(6), 1-12.*

Moghtadaie, L., & Jamshidian, A. (2021). The Effect of Entrepreneurship Education On The Entrepreneurial Attitude, Ability And Aspiration of Rural Women: A Quasi-Experimental Study. *Journal of Entrepreneurship Education*, *24*, 1-22.

Mohseni, A., Mousavi, S.H., & Jamali, M. (2013). The role of entrepreneurship training on students' entrepreneurial attitude and general self-efficiency beliefs. *Quarterly Journal of Research and Planning in Higher Education*, *19*(3), 63-80.

Nieman, G. (2001). *Training entrepreneurs. Journal education and training, 43(8-9), 445- 450.*

Olafisan, O.D & Adebisi, T.A. (2022). Awareness of Entrepreneurial Opportunities in Courses of Study Among Undergraduates of Obafemi Awolowo University Ile-Ife, Nigeria. *Journal of Entrepreneurship Education, 25(5), 1-7.*

Parsa, A., Abdolvahabi, M., Zarif, S. (2011). *Investigating the Impact of Problem Solving Methods on Entrepreneurial Personality. Entrepreneurship Development, Fourth Year, No. 14, 145-164.*

Passaro, R., Quinto, I., & Thomas, A. (2021). Can universities support the entrepreneurial intention? Putting entrepreneurial education into practice. *Journal of Entrepreneurship Education*, *24*, 1-15.

Postigo, S. (2002). Entrepreneurship education in Argentina: The case of Sananders University. paper presented at The Internationalizing in Entrepreneurship Education and Training Conference.

Rahai, Z. (2007*).* The Role of University in Creating and Balancing the Capacities and Entrepreneurial Opportunities. Collection of articles of the First Conference on Employment and Higher Education*", Tehran: Jahad University Press, 394-395.*

Ranjbarian, R. (2014). *The Role of Higher Education in Entrepreneurship Development. Social, Economic, Scientific and Cultural Monthly Journal of Work and Society, 167, 60-66.*

Saber, F. (2002). The ways of women's entrepreneurship development in Iran. *Intellectuals and Women's Studies.*

Sharif, SM., Jamshidian, R., Rahimi, H., Naderi, N. (2011). *An Analysis of the Status of Entrepreneurship Education in Iran's Higher Education. Entrepreneurship Development, Third Year, No. 11, 87-106.*

Sookhtanlo, M., Rezvanfar, A., Hashemi, S. M., & Karaj, I. (2009). Psychological capabilities affecting agricultural students' entrepreneurship level: a comparative study. *Research Journal of Agriculture and Biological Sciences*, *5*(2), 175-184.

Su, Y., Zhu, Z., Chen, J., Jin, Y., Wang, T., Lin, C.L., & Xu, D. (2021). Factors influencing entrepreneurial intention of university students in China: integrating the perceived university support and theory of planned behavior. *Sustainability*, *13*(8), 4519.

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.

Talebi, K., Zare Yekta, M.R. (2008). *Academic Entrepreneurship Education and Its Role in Creating and Developing Small and Medium-Sized Knowledge Based Enterprises. Entrepreneurship Development, Year 1, No. 1, 111-131.*

Tuffour, S.A., & Bunyaminu, A. (2022). A Model of Factors That Influence the Effectiveness of Entrepreneurship Education in Ghanaian Technical Universities. *Journal of Entrepreneurship Education, 25*, 1-12.

Vatankhah, N., & Moghaddam, K.R. (2015). Recognizing the students' entrepreneurial spirit: the case of Agricultural College, Shiraz University. Iranian Agricultural Extension and Education Journal, 11(1).

Yaddollahi Farsi, J. (2007). *The New Role of Universities: Developing Entrepreneurial Capabilities. Proceedings of the first Conference on Occupation and Higher Education, Tehran: Publishing. Tarbiat Modares: Jahad University Press.*

Zali, M.R. (2006). *Fictions or facts of entrepreneurship: Entrepreneurship Education in Universities. Research Center of Applied School of Management, Tehran University.*

Received: 03-Feb-2023, Manuscript No. AJEE-23-13224; **Editor assigned**: 06-Feb -2023, Pre QC No. AJEE-23-13224(PQ); **Reviewed**: 20-Feb -2023, QC No. AJEE-23-13224; **Published**: 28-Feb -2023

Citation Information: Kamran, M.A., Afsharfar, S., Al Shukaili, A.G., & Al Shaqsi, A.(2023). Effect of University Undergraduate Education on Students' Entrepreneurship Spirit, Case Study: German University of Technology In Oman. *Journal of Entrepreneurship Education, 26*(S3),1-15.