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Technopreneurial Skills Development in Higher Education: Exploring the Influence of Gender and Educational Level

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Abstract

In today's era, possessing adequate technological and entrepreneurial skills is crucial for the academic and professional success of all individuals. Higher education institutions are playing a vital role in equipping students with the necessary skills to thrive in today's technological age. However, there is a dearth of empirical studies that examine how educational level and gender affect the technopreneurial skills of university students. Thus, the study investigates the impact of gender disparities and education levels on higher education students' technopreneurial skills in the 21st century. The research utilized quantitative design methods, incorporating an online survey administered via Google Forms to collect data from two hundred (N=200) through a diverse sample of university students. Descriptive and t-test analyses were conducted to examine whether there were significant differences in technopreneurial skills according to education levels and genders. The results showed students' skills ranged from average to higher levels, and also slight differences were observed, but they were not statistically significant based on both gender and educational levels. The findings of the study add to the increasing research on gender and 21st-century technopreneurial skills in higher education institutions. They highlight the importance of continuous efforts to establish inclusive and equitable 21st-century technopreneurial skills for higher education students' surroundings. To improve the entrepreneurial skills of higher education institutions, educators, researchers, policymakers, and institutions need to focus on 21st-century skill strategies at all education levels. They should also customize their entrepreneurial skills to design programs that cater to the diverse development of the higher education curriculum in technopreneurial skills.

Keywords: Gender, 21st-Century Entrepreneurial Skills, Higher Education, Students, Technopreneurial Skills

Introduction

The 21st-century technopreneurial skills present themselves with rapid change in technologies; this requires evolving entrepreneurial skills for the 21st century, which have become a critical engine of global economic growth and invention within technological advancement skills (Alshebami & Seraj, 2022). A notable phenomenon witnessed in this century is the heightened interest in the globalization of socio-economic activities, aided by information and communication such as technologies (ICT) (Abbas, 2018). Higher education institutions play an essential role in preparing the future workforce by providing innovative alternatives to accessing the knowledge and skills necessary to thrive in a changing world that is fully competitive, such as self-employment work as an option to acquire a living (Pittaway, 2021). Entrepreneurial competencies are vital for establishing and launching alternative activities as well as supporting innovative, adaptable, and responsible pursuits to overcome the challenges of market shifts.

In the realm of higher education, the acquisition of 21st-century technopreneurial skills leads to abilities in positions of importance, opening up increasing entrepreneurial careers within the technology equipment (Nabi et al., 2021). It has been found that gender and educational level are key factors in the development of these abilities. However, the global level of gender education remains a challenge, hindering progress in this area. Nevertheless, there is an optimistic outlook for entrepreneurial talent in today's highly globalized educational requirements. Our study confirms the crucial role that entrepreneurial skills play in higher education in a nation's economic growth within the educational landscape (Musoke & Badru, 2018). Moreover, the transition of entrepreneurial skills from underdevelopment to an industrial-based educational level has been linked to the rate of skills acquisition, adoption of communication technology, and innovation among educators (Zaidi et al., 2014).

In a study conducted by Bejinaru (2018), entrepreneurial skills are argued to be an integral part of the workforce to enhance students' ability to think creatively in a real-world business environment, make successful choices, overcome complex challenges, and generate innovative ideas in unfamiliar and emerging employment experiences (Bejinaru, 2018). These skills are acquired through higher education and are influenced by gender perceptions. It is predicted that in the coming years, the growth of entrepreneurial skills and the use of technology, such as computers and smartphones, will greatly contribute to the accumulation of knowledge known as 21st-century technopreneurial skills. This development will create colleges that merge tech and business, leading to the birth of new enterprises that try to boost their success on a world level (Ahmad et al., 2023). More so, the growth of complicated advanced talents in higher education, meant to facilitate life in the 21st century, has ironically made it more difficult. Research conducted recently, for example, noted that undergraduate and postgraduate degrees create different paths for

males and females to develop their entrepreneurial skills (Santos-Jaén et al., 2022).

Higher education institutions are expected to embrace entrepreneurial skills in the future as a result of workforce requirements (Ana et al., 2018), which means job skills will change quickly, and higher education institutions are required to update their curricula to be relevant and develop entrepreneurial skills to help them launch profitable careers. The next crucial step is understanding how gender engages competitiveness in entrepreneurial skills in higher education opportunities, including the entrepreneurship education field, to meet the constant demands of today's globalized labor market (Sahin et al., 2019). The development of higher education students' 21st-century technopreneurial skills is crucial in fostering their ability to contribute to work skills, which is essential for the growth of competitive student entrepreneur initiatives (Jardim, 2021). The importance of technology in processing work skills has become crucial for employees in the 21st-century workplace, which is centered on knowledge and information-based activities (Abubakari et al., 2023b; Putnam & Sanchez, 2019). Studies have demonstrated that in higher education institutions, there is a need to address gender gaps in the development of entrepreneurial skills. It is fascinating to see a recent study examining the development of entrepreneurial skills among individuals in higher education, particularly focusing on potential gender differences (Ferreras-Garcia, Sales-Zaguirre et al., 2021). Some past scholars, based on their observation of their findings, contend that women might face distinct challenges and possibilities in the business world, which would result in differences in skill formation and self-articulation levels (Yordanova et al., 2020). Thus, more empirical-based studies are necessary to verify how gender and education level impact the development of 21st-century technopreneurial skills in different settings.

The nurturing of entrepreneurial talent and skills in students at tertiary levels has piqued the interest of many. For instance, one such work by Ratten and Usmanij highlights gender differences in skills at various levels and types of education qualifications (Ratten & Usmanij, 2021). It shows how the educational attributes of a person impact one's suitability for a vacancy, at whatever level - undergraduate or postgraduate degrees. The research findings indicate that there is great potential for higher education institutions to develop 21st-century skills through the inculcation of a wider range of entrepreneurial skills. The study underlines the entrepreneurial skills of higher education. The results also show an interesting point, that is, gender may not have a significant influence on predicting students' skills based on their program. This will also help, as the findings give valuable insights for the improvement of entrepreneurial skills of students in higher education, to educators, and even to policymakers.

Studies, however, have not converged on the influence of gender on entrepreneurial abilities in institutions at the scholastic level, especially considering that males and females are involved in entrepreneurial activities. More empirical data is unquestionably required in future research to fully articulate how, besides educational

levels, gender may influence the entrepreneurial skills of students in higher education. Therefore, the paper set out to explore the relationship that may exist between skills, gender, and education. It proposes three fundamental aspects to be analyzed: 1) the current state of entrepreneurial skills in higher education; 2) gender differences in the development of entrepreneurial skills; and 3) the impact of educational levels on the development of entrepreneurial skills at different academic levels.

Literature Review

21st-Century Technopreneurial Skills and Related Studies

Based on previous studies, the term "technopreneurs" does not have a universal definition (Ratten, 2023). The utility of entrepreneurship in society has generated sub-dimensions of the field of study, at which to date it has become daunting to evolve a clear conception toward the precise definition of each component in varied contexts. It may be used in phrases like "enterprise mindset" and "endeavors" as well as words such as "trait-based position," "focused on competencies approach," and "contributions of business owners" (Abdul, 2018). Some researchers investigated entrepreneurship skills, such as risk aversion and resolution competencies, in institutions of higher education and found that these skills affect the entrepreneurship mindset of students (Moreno et al., 2019). Earlier research on entrepreneurship education has focused on whether entrepreneurial traits are innate or can be developed through experience and instruction (Arruti & Paños-Castro, 2020). This debate has centered around two approaches to defining entrepreneurship: (1) a competency-based approach that emphasizes entrepreneurship as a skill that can be learned through education and experience and (2) a holistic approach that assesses an entrepreneur's ability to be innovative, competitive, productive, and satisfied with their work based on their entrepreneurial power. However, there have been numerous studies conducted on the acquisition of technopreneurial skills by students of different genders. The primary objective of this paper is to examine gender disparities and education levels in 21st-century technopreneurial skills in higher education students.

The study conducted by some scholars underlines the importance of gender mainstreaming and diversity in the workforce development process and practice to produce a skilled and innovative workforce that can drive growth and prosperity in entrepreneurial activities (Wei & Duan, 2023). This, according to the study, falls within problem-solving and self-employment skills and clarifies what 21st-century technopreneurial skills and job market competencies should be, like creativity and innovation. These are the skills that colleges are trying to instill in students to be able to identify market opportunities. For example, taking more courses on entrepreneurial skills and leadership will help in career advancement within higher education institutions. Research has shown that higher education institutions significantly influence the success of Technopreneurship (Janssen et

al., 2020). Technopreneurial skills can be defined as the process of inculcating the urge and capacity to initiate a business venture by exploiting resources creatively and innovatively from established business norms. More studies have been published on this (Levels, 2022). The use of Analysis of Attitudes and Approaches to Problem-Solving: Gender Differences and Education Levels suggests that students will have varied problem-solving skills based on their sex. These differences should be informed by their abilities associated with thinking creatively toward higher learning, the application for entering or joining a business, and knowledge acquisition on starting or running a business, either individually or as a group of graduates.

The arguments put forward by some scholarly works indicate that there is an enormous interest in the entrepreneurial skills of the 21st century, which have been defined as the skills sought most by students in higher education (Barrientos-Báez et al., 2022). The connection between entrepreneurship and education is, therefore, interest's main driver ever since it gained momentum in the latter part of the 20th century. This research holds an optimistic view: Students who successfully gather entrepreneurial acumen to be entrepreneurs will, in the end, find employment in various sectors (Sutopo, 2019). Both genders, who are interested in having a well-qualified workforce and fulfilling their dreams of having a top-notch workforce, are interested in this concept of entrepreneurship. It also involves bright, eager business owners and students in college who want to develop new products and understand opportunities through company efforts and the required skills in their lives. All these parts have been brought out in past research on the features of entrepreneurship skills in these students.

To keep up with the rapidly evolving business landscape of the 21st century, higher education must update its curriculum to reflect the skills needed by technopreneurs. To create good business projects for success in competitive markets, it is crucial to ensure that education remains relevant to the demands of the industry (Saad et al., 2019). The study asserts that to thrive and succeed in today's ever-changing business world, both genders must possess and develop certain entrepreneurial skills. These skills are considered crucial for students to secure and progress in their professional lives. The study refers to these necessary skill sets as "21st-century skills" and emphasizes their importance for both academic and professional achievements. Higher education institutions play a key role in fostering these skills by preparing a well-educated workforce capable of engaging in competitive entrepreneurship (Abubakari & Kalinaki, 2024; Yenni et al., 2021). Previous research has investigated the relationship between gender-specific 21st-century skills and skills that are directly related to the execution of entrepreneurship education initiatives (Suleiman & Tunbosun, 2019). It has been shown that this is consistent with another research finding that the employment skills gap and the corresponding slowing of economic growth in many emerging educational institutions have been largely caused by a lack of adequate training for the acquisition of such abilities, either in higher education

or in the labor market (Drake & Reid, 2018).

The previous researchers demonstrated a significant connection, suggesting that there are no noteworthy disparities in entrepreneurial skills between males and females who pursue higher education at different levels (Tseng et al., 2019). Similarly, another related study supports a few earlier investigations on the associations among gender, risk-taking attitudes, and entrepreneurial intentions (Gurel et al., 2021). However, it has been discovered that other studies contradict the study on the relationships between gender and learning results in Entrepreneurship Education and Business Plans (Ferreras-Garcia, Hernández-Lara, et al., 2021). The findings report argues that the primary objective of gender is to gain entrepreneurial skills, and the impact of higher education at different levels is to develop the capacity to create in response to the difficulties of 21st-century competition. In addition to identifying the levels of entrepreneurial skills, the current study seeks to ascertain whether entrepreneurial skills differ according to gender and level of education when pursuing higher education.

Research Objective and Questions

The primary objective of this paper is to examine gender and education level disparities in 21st-century technopreneurial skills in higher education students. Thus, the present study aimed to address two research questions (RQ).

1. Is there a gender gap in how higher education students perceive technopreneurial skills?
2. Is there an education level gap in how higher education students perceive technopreneurial skills?

Methods and Materials

Research Design, Data Collection, and Sample

This study adopts quantitative methodologies to examine the characteristics of the study's variables. The researchers gathered data utilizing an online survey administered via Google Forms to a sample of two hundred (200) higher education students who completed the survey and were pursuing degrees in various Indonesian higher education institutions, including a population of undergraduate and postgraduate levels. The questionnaire respondent criteria included students who were primarily pursuing their studies activities in higher education institutions. Invitations were extended to higher education students to provide their responses. The questionnaire was filled out by the participants willingly and without any compulsion.

The questionnaire was divided into four sections. Participants' backgrounds and demographic information are gathered in Section A, which includes questions about participant age, study program, gender, marital status, nationality, education, and course.

Within the gender group, there were 100 male respondents (50%) and 100 female respondents (50%). The marital status of the participants was single for 156 (77.6%) and married for 43 (21.4%).

Instrumentation and Analysis Methods

The framework's instrument comprises three factors aligned with the fourteen (14) competence areas. The factors are (1) Techno-preneurship Development & Implementation (TDI), (2) Techno-preneurship Skills Awareness (TSA), and (3) University Role in Techno-preneurship (URT). Factor one has seven items, factor two has four items, and factor three has three items. All research items were assessed using a 5-point Likert scale ranging from five (= Strongly Disagree) to one (= Strongly Agree). The item's questions mainly focused on 21st-century skills and developing entrepreneurial skills for future business. The self-administered tool was disseminated to participants in higher education institutions via email and WhatsApp for both genders. From a preliminary analysis, the current study demonstrated high reliability indicated by Cronbach's score of frequency scale reliability statistics, Cronbach's α (point estimate 0.881 = Reliability value), 95% CI lower bound = 0,855 and 95% CI upper bound 0,904. Moreover, for data analysis of the current study, the demographics were determined through Microsoft Excel (Microsoft Office 365), descriptive statistics (means and standard deviations), and T-tests were analyzed with JASP software (JASP Team, 2023).

Results

Descriptive Results

Using descriptive statistics– Mean (M) and standard deviation (SD), we evaluated the descriptive statistics to demonstrate descriptively the three (3) factors related to 21st-century entrepreneurial skills in higher education students. Using a range of one (1) to five (5) scale, the values from 1 to 3 indicate a below-average level, between 3.1 to 4.4 indicates a moderate level, and above 4.5 indicates a higher level of skills. The descriptive results of the study are summarized in Tables 1 and 2. The M score for items ranged from 4.7 to 3.5, indicating that the student sample possesses intermediate 21st-century entrepreneurial competencies for each item. The results from the analysis show that (M) scores of individual items from all three areas range from Min = 3.5 to Max = 4.7, indicating that the student sample has moderate to higher levels of technopreneurial skills. The report on data analysis demonstrates a student's 21st-century entrepreneurial skills, with a detailed analysis of gender and education level for each item in the sample area. On average, students in higher education had an average level of 21st-century entrepreneurial skills. Females obtained the highest result, with an M score of 4.44 based on gender and education

level.

Table 1: Descriptive statistics results of individual items of technopreneurial skills (N = 200)

Item	**Mean (M)**	**SD**
TSA1	4.67	0.59
TSA2	4.55	0.63
TSA3	4.39	0.71
TSA4	4.47	0.72
URT1	3.55	0.88
URT2	4.01	0.87
URT3	3.95	0.91
TDI1	4.39	0.68
TDI2	4.46	0.65
TDI3	4.37	0.68
TDI4	4.47	0.66
TDI5	4.56	0.59
TDI6	4.29	0.75
TDI7	4.54	0.68

Table 2: Descriptive statistics results of aggregated technopreneurial skills (N = 200)

Variable (Aggregated Skill)	**Mean (M)**	**SD**
TSA	4.54	0.52
URT	3.83	0.65
TDI	4.44	0.50

Table 3: Descriptive statistics results based on gender (N = 200)

Gender	Variable	Mean (M)	SD
Female	TSA	4.55	0.50
Male	TSA	4.52	0.54
Female	URT	3.82	0.59
Male	URT	3.85	0.70
Female	TDI	4.44	0.49
Male	TDI	4.43	0.51

Table 4: Group descriptive results based on the educational level

Variable	Educational Level (Group)	N	M	SD
TSA	Postgraduate	91	4.53	0.52
	Undergraduate	109	4.54	0.51
URT	Postgraduate	91	3.90	0.59
	Undergraduate	109	3.77	0.68
TDI	Postgraduate	91	4.41	0.50
	Undergraduate	109	4.46	0.49

The descriptive statistics results for females in each indicator, as presented in Table 3, demonstrate marginally higher levels of entrepreneurial competencies in each factor, namely TSA (M 4.55), URT (M 3.82), and TDI (M 4.44). However, this difference between females and males is statistically insignificant and thus does not affect the competence areas concerning gender (see Table 5) and education level (see Table 6). As per the results of the group descriptive, as Tables 3 and 4 depict, our study indicates that entrepreneurial skills (levels) ranged from 3.8 to 4.5. The study involved undergraduate and postgraduate students, and the results reveal that both male and female students have different scores, with females scoring higher. Specifically, female students score higher in TSA (M = 4.53) among postgraduate students with N = 91. In contrast, male students score higher in TDI among undergraduate students, with M = 4.54 and N = 109, and URT scoring among postgraduate students, with N = 91 and M = 4.41, is the highest result. However, these score differences are not statistically significant when comparing the skills of male and female students.

T-Test Results Based on Gender and Educational Level

An independent t-test was conducted on the estimated education level variances across genders. This was done within each category of entrepreneurial skill competence after confirming the satisfaction of Leavens' test and the P-values being greater than 0.05. The M scores were obtained by averaging each skill area's item-based calculations. Furthermore, the effect size was calculated using the Cohen coefficient d parameter, and a P value higher than <0.05 was considered significant. The results of the independent t-test and descriptive statistics are presented in Tables 5 and 6, respectively. Table 5 is based on gender, with male responses (N = 100) and female responses (N = 100). According to the descriptive analysis in Table 6, there are no noticeable differences between postgraduate and undergraduate students in terms of their entrepreneurial skill sets.

Table 5: Independent samples T-Test results based on gender

Variable	**t**	**df**	**p**	**Cohen's d**
TSA	0.464	198	0.643	0.066
URT	-0.306	198	0.76	-0.43
TDI	0.2	198	0.842	0.028

Table 6: Independent samples T-Test results (Based on Education Level)

Variable	t	df	p	Cohen's d
TSA	-0.133	198	0.894	-0.019
URT	1.432	198	0.154	0.203
TDI	-0.822	198	0.412	-0.117

The descriptive values of the student t-test show that, based on the educational level of students, there are no significant disparities in their technopreneurial skills, as per Table 6. The P-value of > 0.05 verifies this. Moreover, as Table 5 shows, there are no gender differences among individuals possessing technological skills in higher education. Thus, the results suggest that gender and educational levels may not be significant predictors of the technopreneurial skills of students in higher education settings.

Discussion and Implications

From the descriptive and t-test analysis, this study ruling to address research questions (RQ1) and (RQ2) which were resolved in which, generally, students possessed

an average level of skills in each area, with females' average indicating slightly higher levels of TSA, URT, and TDI than males level average. However, these variations were not significantly different. The descriptive results can help identify areas where individuals excel or struggle within the t-test analysis.

The results and statistics gathered from this study can be highly beneficial for researchers and educational institutions. They can guide them in designing higher education programs, initiating entrepreneurial ventures, and helping empower gender entrepreneurs in pursuit of their aspirations within the higher education system (Wong et al., 2020). Furthermore, the data can assist interested parties in quantitatively improving educational institutions or developing educational initiatives that aim to enhance students' skills in educational settings.

The descriptive results of the t-test showed that there were no significant differences between male and female students in any of the competence areas. All P-values were higher than the 0.05 significance level of student scores. Although female students had a slightly higher level in Table 3, the group's descriptive was based on the education level of both males and females in each area of the t-test results. The absence of statistically significant differences indicates that male and female students have similar levels of fundamental ability to be entrepreneurs. A significant number of participants in the quantitative data analysis believed that having 21st-century entrepreneurial skills helped them understand better, which, in turn, helped businesses become more aware of creating relevant job skills(Abdul, 2018).

The study emphasizes that students in higher education, regardless of gender, need to have 21st-century technological skills such as critical thinking, creativity, problem-solving, teamwork, and communication to be successful as future business owners (Nowiński et al., 2019). This study challenges the widespread belief that males are typically more skilled and competent than females in higher education-related activities, as found in previous research (Abubakari et al., 2023a; Chestnut & Markman, 2018). Therefore, it is essential to appreciate unique entrepreneurial talents and abilities rather than making presumptions based on gender. Another study (Napp & Breda, 2022) stereotyped males as lacking talent, but a worldwide investigation has revealed that, at most educational levels, both genders possess equal skill sets.

The findings of this study have significant implications for students aspiring to higher education, especially since higher education institutions nowadays are equipped with competent gender skills. It is crucial to ensure that these institutions provide accessible and helpful facilities that facilitate the acquisition of 21st-century entrepreneurial skills for both male and female students. Currently, there are no significant differences between genders in terms of entrepreneurship skills practice in higher educational institutions.

According to the findings, universities need to encourage entrepreneurial initiatives and develop gender-specific course contents that emphasize modern 21st-

century technopreneurial skills. The objective is to create a supportive atmosphere where all participants, irrespective of their race, feel confident and at ease utilizing their entrepreneurial capabilities (Vîrban, 2014). Leveraging higher education to develop technopreneurial skills and promote collaborative work initiatives can enhance 21st-century skills (Block et al., 2023).

One of the primary mandates of 21st-century technopreneurs is to provide alternative tools that use technology, offering higher education students access to entrepreneurial skills. This will enable them to use resources in the environment of the 21st century to establish their entrepreneurial ventures further and heighten the possibility of success in the field (Santos-Jaén et al., 2022). Development opportunities for these skills should be integrated into higher education programs across all universities (Abubakari et al., 2023a). This helps in fostering creativity and enhancing the capacity of individuals and institutions to grow entrepreneurial opportunities, in particular, the gender gap should be addressed. The delivery system of education should also promote critical and problem-solving entrepreneurial skills, more specifically among females.

Conclusion

The present study analyzed the influence of gender and education level in higher education and the impact on 21st-century technopreneurial skills. The questionnaire utilized in the study effectively captured the students' entrepreneurial skills, enabling a thorough assessment of their abilities based on their understanding and mindset in the competency area, regardless of gender and academic achievement. Interestingly, the descriptive results of both male and female groups showed that women tended to score slightly higher than men in education-level differences across all areas of items. However, there were no noticeable gender differences in 21st-century entrepreneurial skills. This suggests that there is no significant gender disparity in entrepreneurial abilities and that both male and female students in higher education institutions possess similar degrees of entrepreneurial ability.

Noting some limitations of this study, despite its intriguing findings, is critical. Firstly, because the study used a cross-sectional design, it is not readily to establish a causal relationship between female academic achievement and entrepreneurial skills. Thus, using longitudinal or experimental research designs could be more beneficial to understand better the development of 21st-century entrepreneurial abilities and the factors driving their needs. Secondly, the sample size of the study may not accurately reflect the total population of higher education students in Indonesian universities, but there were enough respondents for statistical analysis.

The results cannot be generalized to other educational institutions fully; therefore, caution in the generalization of the available data from the sample under study is very much

necessary. In addition, the paper would benefit from a more diversified and broader sample of students from different universities in the other provinces of Indonesia. This would give a better evaluation and understanding of gender differences and the level of the environment on entrepreneurial abilities within educational institutions in the 21st century. In so doing, the present study adds to the increasingly large body of research on the modern entrepreneurial skillset of students in higher education, with gender and level of education. The study provides useful insights to researchers, entrepreneurs, administrators, stakeholders, and policymakers concerned with effective strategies for promoting students' entrepreneurial skills in higher education and the support of technopreneurs' skills in higher education institutions (colleges and universities).

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