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Implications of Student Entrepreneurial Traits on Entrepreneurship Education: A Descriptive-Inferential Analysis

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Abstract. Across the globe, there is an increasing demand for entrepreneurship education due to the vital role entrepreneurs play in economic growth. However, to ensure the effective transmission of entrepreneurship education, it is essential to understand the entrepreneurial attributes of students. We profiled the attributes of students in entrepreneurship education at a university of technology in South Africa from a self-perception perspective. We collected data using a survey questionnaire, adopted a quantitative approach and used descriptive and inferential statistics to analyze data from 203 students. A census of the total student population was conducted, and all students willing to participate were included in the study. The results indicated that students reported high levels of entrepreneurial attributes. Students reported high levels of entrepreneurial traits, including confidently pursuing goals, perseverance through challenges, creative problem-solving, adaptability in dynamic contexts, and effective networking. Although a few attributes showed a statistically significant distribution of perceptions among study levels and gender, the findings had important implications for supporting entrepreneurship education curricula and helping students enhance their entrepreneurial attributes. The findings underscore the value of self-perception in assessing entrepreneurial potential and suggest that a structured entrepreneurship education program can further enhance these attributes. These insights can guide educators in designing targeted programs that build on students' strengths while addressing development areas, contributing to a more inclusive and dynamic entrepreneurial ecosystem in South Africa. Future studies should explore entrepreneurial attributes across diverse institutional contexts to develop a comparative national perspective on entrepreneurship education in the country.

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1. Introduction

As entrepreneurship education (EE) gains prominence in academia, questions regarding how "personality factors interact with or are moderated by other individual traits (e.g., education)" (Kerr et al., 2018, p. 29) in developing entrepreneurial behaviors still warrant further research. A gap exists in their intersectional relationships, particularly in how traits support and inhibit entrepreneurship behavior and action development. This gap exists within the unsettled debate of whether entrepreneurs are born or made (López-Núñez et al., 2020) and the desire to reconcile conflicting views about the effectiveness of EE in shaping entrepreneurship behaviors in students. This situation is increasingly contested, considering entrepreneurship is perceived as a sustainable means of stimulating economic activities and addressing many social problems, such as unemployment, poverty, and idleness among the youth.

Notably, EE is lauded for developing important entrepreneurial attitudes, professional knowledge, motivation, and skills (Zhang et al., 2022) and teaching students to understand and learn to be entrepreneurs (Iwu et al., 2025). It can increase students' chances of success in entrepreneurial and traditional employment settings (Le et al., 2024) and influence students to choose self-employment after graduation (Iwu et al., 2020). In short, scholars believe entrepreneurship education can foster characteristics and capabilities among the youth likely to stimulate student entrepreneurial interests, followed by action towards choosing self-employment as a career. Likewise, Cui et al. (2021) stress that EE modifies students' entrepreneurial behaviors and encourages them to become entrepreneurs. However, others disagree with claims that EE positively influences student entrepreneurship mindset development and entrepreneurial interests (Yakubu et al., 2021; Yeboah et al., 2017).

Arguably, the ensuing debates about the effect of EE on student behaviors and the claims that entrepreneurs are born rather than made (López-Núñez et al., 2020) are closely associated with individual traits (Kerr et al., 2018), entrepreneurial intentions, behaviors, performance, and preparation (Saptono et al., 2020). A study examining adolescents' personality, characteristics, and self-employment in adulthood (Viinikainen et al., 2017) alludes to personality, characteristics and risk attitudes that established the nexus between individuals' propensity to become and experience success as entrepreneurs.

These include personality attributes such as the need for achievement and autonomy, innovativeness, proactive personality, generalized self-efficacy, stress tolerance, internal locus of control and conscientiousness, openness, extraversion, and lower neuroticism as predictors of entrepreneurial behavior among the youths. Studies have also found that youths born into entrepreneurial families are likely to become entrepreneurs (Viinikainen et al., 2017), indicating the influence of social and cultural environments on nurturing students' perceptions of entrepreneurship and intentions. Therefore, while entrepreneurship education

nurtures new insights, business skills, and knowledge, the influence of students' innate capabilities, shaped by family, social, and cultural contexts, significantly affects the outcomes of entrepreneurship education.

Given our supposition that students' innate capabilities may impact entrepreneurship education outcomes and the way training is delivered, it is prudent for Higher Education Institutions (HEIs) to understand students' skill sets, strengths, and weaknesses (Sibanda & Iwu, 2023), particularly from the students' perspective. Numerous studies have shown that research on self-perceived views about student entrepreneurship traits is underexplored. For example, Sa and Holt (2019) contend that amidst growing interest in investigating the effect of entrepreneurship education on students, students' motivations and interests, arguably inherited from their background factors, have been mainly ignored.

Similarly, Bahaw et al. (2025) stressed that it is essential for entrepreneurship educators to know the participants' psychological profiles and backgrounds to address each audience's specificities effectively. This step is vital given that entrepreneurship educators recognize the variability of goals among those who pursue entrepreneurship education at HEIs (Aulet, 2017) and because students may hold diverse expectations that may influence engagement in entrepreneurship education programs (Mani, 2015), underlying the need for providing customized entrepreneurship programs.

For example, Sa and Holt (2019) investigated profiles of entrepreneurship students in Canada and found four profiles of entrepreneurship students (i) those seeking experience without an intention to become entrepreneurs, (ii) those exploring entrepreneurship to consider if it is an attractive career option, (iii) those engaging with entrepreneurship, to assess their fit and potential as entrepreneurs, and (iv) those pursuing venture creation set on creating and launching a venture and seeks support in doing so. Thus, such students' profiles may explain the complex behavior of entrepreneurship students since their motivations may differ.

Apart from student profiles, numerous studies equated gender inclusion with female representation for including females in the entrepreneurship discourse, which has traditionally been side-lined in the mainstream, male-biased entrepreneurship discourse (Reyes, 2025). Moreover, the literature (Zhang et al., 2022) presents divergent claims, suggesting that male and female responses to entrepreneurial education differ (Duong & Vu, 2024) and that entrepreneurship education may be perceived as gender-neutral (Zhang et al., 2022).

A significant positive correlation was observed between entrepreneurship education and self-employment intentions among male students, but not among female students (Nowiński et al., 2019). Mani (2015) also observed different gender-related motivations that compel male and female participation in entrepreneurship programs. These findings suggest that these divergent

conclusions indicate the importance of the gender construct in investigating the entrepreneurial traits of undergraduate entrepreneurship students.

The literature (Iwu et al., 2021; Sibanda & Iwu, 2023) proposes that analyzing students' entrepreneurial traits in HEI settings can inform teaching, curriculum development, and policy initiatives, making entrepreneurship education effective. Consistent with this literature, this study investigated students' self-perceptions of entrepreneurial traits of undergraduate entrepreneurship students at a South African HEI. We then examined students' self-reported traits across gender and level of study. The level of study is significant, considering that entrepreneurship education greatly enhances individuals' ability to obtain resources via the sharing of knowledge and information (Handayati et al., 2020).

Similarly, in their study, Welsh et al. (2016) found that entrepreneurial education increases entrepreneurial attitudes, motives, and intentions throughout the academic trajectory, from the first to the final year. There is an evident growth in the variables used to measure entrepreneurial attitudes, motivations, and intentions. However, when examining the relationship among students' grades, year of study, and entrepreneurial intention for entrepreneurship at a business school in the United States of America (USA), Bhandari (2013) found statistical insignificant difference between the student's current year of education (first/second/third/fourth year) – and the student's intention to start a business once they had completed their undergraduate studies. Considering the above divergent results, our study contributes to the ongoing debate on the relevance of the study level on entrepreneurship student traits.

Thus, our study extends the discourse about students' traits and EE by incorporating students' self-reported views. Embracing these views is crucial in developing effective entrepreneurial education and curricula that promote self and formal employment orientation (Makwara et al., 2022) in response to the emerging realities of technology and industrial environments in South Africa.

Moreover, HEIs can then tailor entrepreneurship instruction strategies to create a more personalized learning experience. For instance, if a student has strong leadership skills, a lecturer can design activities that allow the student to take on a leadership role in a group project. Alternatively, if most students have strong analytical skills, a lecturer can design activities focusing on data analysis and problem-solving. By customizing the curriculum, students are more likely to engage with the material and develop a deeper understanding of entrepreneurial concepts. This approach can lead to a more successful and effective entrepreneurial education.

The literature review identified ten characteristics for an investigation: confidence, networking, ability to adapt to change, learning from mistakes, awareness of abilities, preference and behavior, creativity, persistence, writing down goals, leadership skills, and participation in group activities. Thus, the main research question was: To what extent do the entrepreneurial traits of students

determine how best to teach entrepreneurship? Four sub-research questions were designed to address the main research question. They were as follows:
1. Which entrepreneurial characteristics do students perceive they possess?
2. Is there any significant difference in the students' perceptions of the selected entrepreneurial characteristics?
3. Is there any significant difference in the perceptions of the students among the five groups of study levels?
4. Is there any significant difference in the perceptions of female and male entrepreneurship students?

From the above, three hypotheses were developed:
H1. There are significant differences in the perceptions of the students in terms of the selected entrepreneurial characteristics.
H2. The distribution of perceptions among the five groups of study levels is significantly different.
H3. The distribution of perceptions among female and male entrepreneurship students is significantly different.

2. Literature Review

2.1. Theoretical framework

This study is informed by Ndofirepi and Rambe (2017, p. 193) premise "*that entrepreneurship cannot be conceived as a coincidental, serendipitous occurrence of an unconscious individual, but rather a deliberately orchestrated human endeavor*". Thus, we adopted a theoretical assumption that university students make conscious decisions to enroll in courses on entrepreneurship education, along with their set career goals, consistent with Ajzen's 1991 theory of planned behavior. According to (Ajzen, 1991), an individual's behavior is influenced by numerous factors, including intention, social norms, and perceived control over specific events.

Rideout and Gray (2013) stressed that one of the core ideas of Ajzen's theory is that entrepreneurial behaviors are always preceded by entrepreneurial "intentions" that theoretically can be modified by educational experiences. In context, therefore, this study includes the submission that enrolling in entrepreneurship qualifications to develop the skills and be equipped to venture into entrepreneurship after graduation or at a later stage is a planned behavior for developing entrepreneurial traits. As argued in the literature, social norms embedded in family and cultural environments mediate the impact of entrepreneurship education and should be acknowledged. We adopt Hagger (2019) interpretation of Ajzen's (1991) theory as an important resource for examining human behavior and adopting it as our theoretical framework.

2.2. Entrepreneurship attributes

Booysen (2015) highlights that successful entrepreneurs depend on (i) skills, expertise, and aptitudes, (ii) personal qualities, management skills, and (iii) external factors. Skills refer to manual work that can be learned, expertise is knowledge acquired through studying or experience, while aptitudes are individual inherent characteristics. Booysen (2015) further stressed that personal characteristics should be considered equally important apart from skills, expertise, and aptitudes. In India, Mani (2015, p. 13) explored engineering

students' perspectives on entrepreneurship education and gathered that they regarded "decision-making skills, risk-taking ability, creativity, communication skills, and the capability to create business plans" as the key skills for achieving success in self-employment.

The list of attributes for successful entrepreneurs is endless and varies among scholars. However, many tend to emphasize the importance of innate rather than acquired attributes, which entrepreneurship education aims to instill. For example, Booysen (2014) listed passion, belief, courage, determination, instinct, calculated risk-taking, vision, discipline, resiliency, adaptability, inspiration, willingness to learn, internal locus of control, and the need to achieve as key characteristics of successful entrepreneurs.

Similarly, Nicolaides (2011) argued that innovativeness, risk-taking, pro-activeness, creativity and innovation, networking, and learning from failure enhance opportunities for entrepreneurial success. These attributes empower student entrepreneurial capabilities for formal and self-employment purposes. The low rate of students pursuing self-employment opportunities after graduation (Makwara et al., 2022) provides evidence for HEIs that the entrepreneurship education curriculum must be designed to serve a dual purpose - creating jobs and preparing students for employment, from their perspective.

Graduate attributes and employability are critical for an institution and academic success. Since students' success is partially portrayed in their career success, the role of HEIs in helping students develop the skills and knowledge necessary for success in the job market is critical. The industry often reports the misalignment between the skills they seek from graduates and what graduates offer (Iwu et al., 2018), leading to increasing levels of graduate unemployment. To prepare students for a rapidly evolving job market, HEIs must prioritize two key objectives.

First, they should work to identify the needs of employers and tailor their entrepreneurship curricula and programs accordingly. The latter pursuit will help ensure students have the specific skills and knowledge required to succeed in their chosen field. Secondly, HEIs should provide a broad and diverse education that prepares students for various career options and emerging self-employment opportunities. By focusing on both objectives, HEIs can ensure their students are well-equipped to succeed in their career paths.

Integrating practical teaching components into the curriculum is critical for entrepreneurship students to merge theory and relevant hands-on learning experiences. Lackéus (2015) advocated for learning-by-doing approaches, such as problem-based, project-based, and service learning, insisting that students connect the comprehensive definitions of being entrepreneurial to learning-by-doing. In the process, they gain work experience, which they can leverage to enter the job market. These findings are consistent with Sa and Holt (2019) findings, namely that students engage in entrepreneurial education for diverse goals, including familiarizing themselves with the employment environment. Thus, it is

critical for HEIs to carefully consider the potential career paths of students when designing their programs and curricula. In that sense, the design to teach entrepreneurship should prioritize collaborating with the industry to provide relevant experiential learning opportunities such as internships, mentorship opportunities, and capstone projects (Mandyoli et al., 2017; Pardo-Garcia & Barac, 2020). Such opportunities help students apply theoretical knowledge in practical contexts and gain valuable work experience. Even so, whether there is one appropriate way to teach entrepreneurship remains contested.

However, the mantra of creating entrepreneurship graduates equipped with skills to engage with the Fourth Industrial Revolution (4IR) dynamics has become critical in recent years. Equipping graduates to venture into self-employment is a key part of this focus. Thus, entrepreneurship education faces the imperative of equipping sufficient student competencies to benefit from the technological advances experienced in the 4IR era (Nowak, 2020).

2.3. Graduate attributes, 4IR skills, and entrepreneurship attributes

The current debates around higher education student traits, graduate attributes, and the 4IR are layered and multifaceted. At the heart of these debates is how HEIs can best prepare students for the rapidly changing world of work in the 4IR. Others argue that soft skills such as communication, problem-solving, and creativity (Pardo-Garcia & Barac, 2020) are just as necessary, if not more so, in the 4IR and should not be overlooked. Table 1 shows an overlap in the graduate attributes, skills required in the 4IR, and attributes for successful entrepreneurs. Thus, the overlap confirms the need to be cognizant of entrepreneurship graduates with skills relevant to the 4IR era.

Table 1: Employability skills for 4IR, Graduate attributes, and Entrepreneurs' success attributes

Employability skills needed for 4IR. (World Economic, 2016)	**Critical graduate attributes** (Iwu et al., 2018, p. 69)	**Attributes critical for entrepreneurs' success -** adapted from - Booysen (2014, pp. 28-29)
1. Complex Problem Solving 2. Critical Thinking 3. Creativity 4. People Management 5. Coordinating with Others 6. Judgement and Decision Making 7. Emotional Intelligence 8. Service Orientation 9. Negotiation 10. Cognitive Flexibility	1. Willingness to learn 2. Commitment 3. Dependability/reliability 4. Self-motivation 5. Teamwork 6. Communication skills - oral 7. Co-operation 8. Communication skills - written 9. Drive/energy 10. Self-management 11. Motivation 12. Problem-solving ability 13. Analytic ability 14. Flexibility 15. Initiative 16. Logical argument	1. Confidence 2. Networking 3. Ability to adapt to change 4. Learning from mistakes 5. Creativity 6. Persistence 7. Awareness of abilities, preferences and behavior 8. Writing down goals 9. Leadership skills 10. Participation in group activities

	17. Adaptability (intellectual) 18. Numeracy 19. Adaptability (organizational) 20. Ability to cope with pressure 21. Time management 22. Rapid conceptualization of issues 23. Research skills 24. Self-confidence	

In summary, we argue that individual profiles of students linked to their interest in entrepreneurship are critical determinants of student success and the likelihood of starting their businesses after graduation. They also predispose students to pursue job opportunities (Sa & Holt, 2019). For example, Ndofirepi (2020) emphasized the importance of considering individuals' underlying motivations and traits when developing interventions to foster future entrepreneurship.

In line with this view, this study investigated self-perceptions of entrepreneurial characteristics of students of entrepreneurship education at a South African HEI. This study focused on the ten traits, drawn from literature, that are commonly associated with entrepreneurship: These are confidence, networking, ability to adapt to change, learning from mistakes, awareness of abilities, preference and behavior, creativity, persistence, writing down goals, leadership skills, and participation in group activities.

3. Methodology

3.1. Research design

The study aimed to profile the entrepreneurial attributes of students of entrepreneurship education at a university of technology in South Africa from a self-perception perspective. Thus, we adopted a positivist paradigm to investigate perceptions of students' entrepreneurial traits and utilized primary data. This study adopted a quantitative approach to collect and analyze the data. The study used a questionnaire survey ideal to collect quantified responses from students.

3.2. Respondents

The study had a population size of 512 full-time students registered for the Diploma in Entrepreneurship, either full-time or extended programs, as extracted from the institution's records.

3.3. Data collection instruments

We collected data from selected students about the ten entrepreneurship attributes in Table 1 derived from the literature review. A four-point Likert scale questionnaire with ten statements was distributed to face-to-face respondents during class with the help of class representatives. Students rated their responses using a scale from Strongly Disagree (1), Disagree (2), Agree (3), Strongly Agree (4). The questionnaire design excluded the mid-point to compel a response and avoid misuse (Kankaraš, & Capecchi, 2024). We applied reverse coding to statements 2, 4, 6, 8 and 10 to strengthen the questionnaire and ensure that

respondents avoided just ticking the boxes. For example, statement 2 would typically be 'I am comfortable raising my opinion in discussions'. However, it was reverse coded to 'I find it difficult to raise my opinion in discussions'. The Cronbach alpha for the ten items was 0.744, with values between 0.7 and 0.749 when deleted.

3.4. Data collection process

A full population census was conducted, and all students willing to participate were included in the study. Informed consent was obtained from the participants. Among the 300 questionnaires distributed to the respondents using a simple random sampling, only 203 usable questionnaires (68%) were returned for analysis.

3.5. Data analysis

Cronbach's Alpha was used to test the internal consistency of the variables, while descriptive statistics were used to analyze the data (mean and standard deviation). Furthermore, inferential statistics were applied. Using a normality test, the data did not follow a normal distribution. Hence, the Shapiro-Wilk test of normality, the Chi-square Goodness-of-fit, and the Kruskal Wallis H and Mann-Whitney U tests were applied to test the significance of differences in perceptions among the ten variables measured. This is consistent with the principle that when data are obtained from ordinal scales, such as a four-point Likert scale, or do not meet the normality assumption, it is recommended to use non-parametric tests such as Chi Square and Mann-Whitney U tests (Chyung et al., 2017).

3.6. Ethical consideration

We obtained permission to collect data, and participants were briefed and informed of the measures taken to safeguard their data. Furthermore, participants were assured of their anonymity and given the option to withdraw from completing the questionnaire at any stage if they felt the need to do so.

4. Results

The sample had 81 (39.9%) males and 122 (60.1%) females, totaling 203 students. Students were from two streams: the extended: year 1 = 21 (10.3%) and year 2 = 19 (9.3%) and the mainstream: year 1 = 68 (33.3%), year 2 = 54 (26.5%) and year 3 = 42 (20.6%).

4.1. Entrepreneurial characteristics, exhibited by the students.

Table 2 presents ten variables capturing the self-perceptions of the entrepreneurial frequency of characteristics. The frequencies of students who selected ‘Agree’ or ‘Strongly Agree’ were summed together for positively worded statements (1, 3, 5, 7, and 9). In contrast, frequencies of students who selected ‘Disagree’ or ‘Strongly Disagree’ were added together for negatively worded statements (2, 4, 6, 8 and 10).

They were ranked, based on the percentage of agreement, among participants as follows: (1) statement 1 (95%), (2) statement 7 (94%), (3) statement 5 (92%), (4) statement 9 (82%), (5) statement 3 (81%), (6) statement 4 (68%) and (7) statement 6 (55%). For three statements, the level of agreement was below 50% (8) statement

2 (49%), (9) statement 8 (39%), and (10) statement 10 (23%). These rankings are also visually presented in Fig. 1.

Table 2: Frequencies of all entrepreneurial characteristics

Characteristic	SD	D	A	SA	Total A/D	Rank
1: I am confident in my ability to succeed	6 (3%)	3 (2%)	56 (28%)	132 (67%)	188 (95%)	1
7: I am aware of my abilities, preferences and behavior	7 (4%)	5 (3%)	94 (48%)	89 (46%)	183 (94%)	2
5: I believe in learning from my mistakes	5 (3%)	10 (5%)	60 (30%)	122 (62%)	182 (92%)	3
9: I am not frustrated by disappointments, and I keep on trying	10 (5%)	24 (12%)	94 (48%)	67 (34%)	161 (82%)	4
3: I enjoy making new friends, maintaining good relationships with them	11 (6%)	26 (13%)	90 (45%)	71 (36%)	161 (81%)	5
4: I find it difficult to adapt to change	37 (19%)	97 (49%)	51 (26%)	11 (6%)	62 (32%)	6
6: I prefer using proven ways of doing things than trying new ways	26 (13%)	80 (41%)	68 (35%)	19 (10%)	87 (45%)	7
2: I find it difficult to raise my opinion in discussions	34 (17%)	62 (31%)	81 (41%)	20 (10%)	101 (51%)	8
8: Writing down goals is not necessary as long I know what I want to achieve	30 (15%)	47 (24%)	72 (37%)	47 (24%)	119 (61%)	9
10: I am comfortable when someone leads me to do some tasks	10 (5%)	35 (18%)	109 (56%)	41 (21%)	150 (77%)	10

Key: Strongly Disagree = SD, disagree = D, agree = A, Strongly Agree = SA

The above summary answers the first research question, RQ1, *which entrepreneurial characteristics do students perceive they possess?*' Figure 1 illustrates that at least 50% of participants perceived seven out of ten characteristics concerning entrepreneurship. These were confidence, awareness of abilities, preferences and behavior, learning from mistakes, persistence despite frustrations, networking, adapting to change, and creativity.

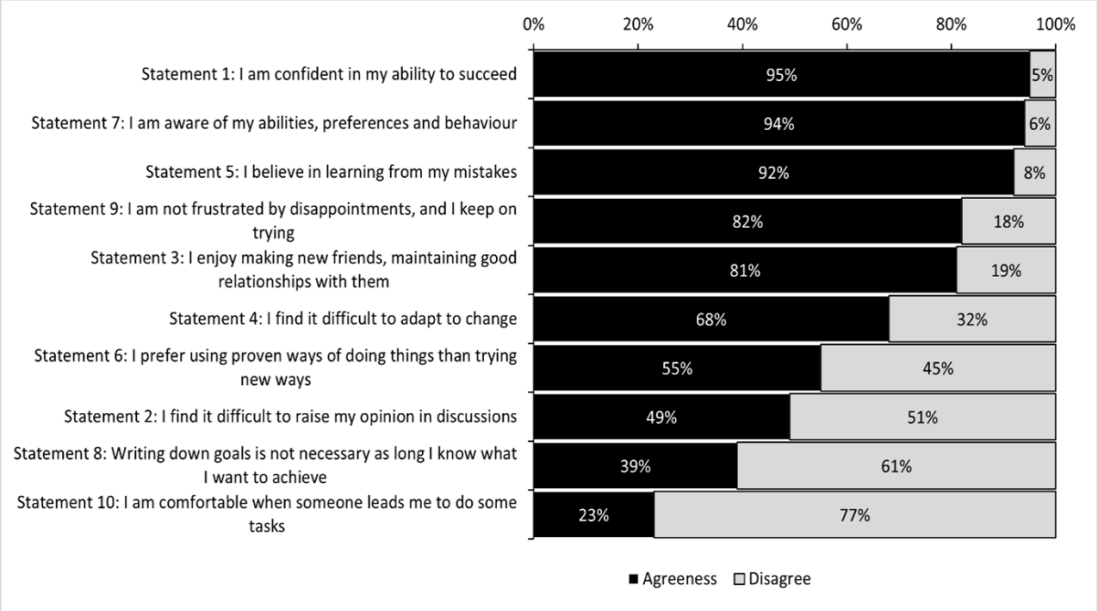

Figure 1: Frequencies of the entrepreneurial characteristics

As illustrated in Table 3, a Shapiro-Wilk test was conducted to determine the data distribution pattern, followed by inferential statistics analysis.

Table 3: Test of normality – Shapiro-Wilk

Variable	Statistic	Df	Significance
I am confident in my ability to succeed	0.605	186	<.001
I find it difficult to raise my opinion in discussions	0.867	186	<.001
I enjoy making new friends, maintaining good relationships with them	0.817	186	<.001
I find it difficult to adapt to change	0.856	186	<.001
I believe in learning from my mistakes	0.661	186	<.001
I prefer using proven ways of doing things to trying new ways	0.869	186	<.001
I am aware of my abilities, preferences, and behavior	0.713	186	<.001
Writing down goals is not necessary as long I know what I want to achieve	0.868	186	<.001
I am not frustrated by disappointments, and I keep on trying	0.813	186	<.001
I am comfortable when someone leads me to do some tasks	0.816	186	<.001

The Shapiro-Wilk normality test of all ten variables gave significant p-values. Therefore, the data did not follow a typical distribution pattern hence warranted using non-parametric tests (Orcan, 2020) to analyze the data. Therefore, Chi-square Goodness-of-fit, the Kruskal Wallis H and Mann-Whitney U tests were applied to test the significance of differences in perceptions among the ten variables measured and the statistical significance of the distribution in perceptions in the levels of study and gender, respectively.

4.2. Students' perceptions of the selected entrepreneurial characteristics

To answer the second research question (RQ2), 'Is there any significant statistical difference in the perceptions of the students on the selected entrepreneurial characteristics?' similar to H1, 'There are no significant differences in the perceptions of the students for the selected entrepreneurial characteristics', the Chi-square goodness-of-fit test was used. The Chi-square Goodness-of-fit test results in Table 4 show that none of the cells had expected frequencies less than five, denoted by [a], [b], [c], [d] and [e]. The minimum expected cell frequency was 49.3, 49.5, 49.0, 48.3 and 48.8 for [a], [b], [c], [d] and [e], respectively. All ten statements on entrepreneurial characteristics indicated a significant statistical difference in the students' perceptions, as the p-value was less than 0.05. Therefore, the differences in perceptions of all the ten characteristics did not happen by chance.

Table 4: Chi-square Goodness-of-fit test results

Variable	Chi-Square	Df	Asymp. Sig.
I am confident in my ability to succeed	221.376[a]	3	<.001
I find it difficult to raise my opinion in discussions	45.863[a]	3	<.001
I enjoy making new friends, maintaining good relationships with them	83.576[b]	3	<.001
I find it difficult to adapt to change	79.510[c]	3	<.001
I believe in learning from my mistakes	180.848[a]	3	<.001
I prefer using proven ways of doing things than trying new ways	56.969[d]	3	<.001
I am aware of my abilities, preferences and behavior	150.251[e]	3	<.001
Writing down goals is not necessary as long I know what I want to achieve	18.327[c]	3	<.001
I am not frustrated by disappointments, and I keep on trying	950[e]	3	<.001
I am comfortable when someone leads me to do some tasks	110.374[e]	3	<.001

After that, the significance of differences in the participants' perceptions over (i) the level of study and (ii) gender was measured. The above test was done to answer the third research question (RQ3), "Is there any significant statistical difference in the perceptions of the students among the five groups of study levels" and correspond to H2. 'The distribution of perceptions among the five groups of study levels was not significantly different'. The results are illustrated in Tables 5 and 6.

Next, the study analyzes the differences between the five groups of study levels.

4.3. Differences in the perceptions of the students among the five groups of study levels

Of the ten variables, only three presented statistically significant differences between various levels of study:

(1) I am confident in my ability to succeed

The distribution of perceptions was not similar across all five groups, as indicated by the mean ranks in Table 6. There were statistically significant differences in

students' mean ranks across levels of study, $X^2(4) = 50.421$, $p < 0.001$. From Table 6, Extended Year 1 group students had a low rank of 31.02, which deviated from all the other groups investigated.

(2) I believe in learning from my mistakes
The distribution of perceptions was not similar across all five groups, as indicated by the mean ranks in Table 6. There were statistically significant differences in students' mean ranks across levels of study, $X^2(4) = 19.021$, $p < 0.001$. As indicated in Table 6, Extended Year 1 and Extended Year 2 groups scored average mean ranks of 61.14 and 85.94, respectively, which deviated from all the other groups investigated.

(3) Writing down goals is not necessary as long I know what I want to achieve
The distribution of perceptions was not similar across all five groups, as indicated by the mean ranks in Table 6. There were statistically significant differences in students' mean ranks across levels of study, $X^2(4) = 14.981$, $p = 0.005$. Mainstream Year 2 and Mainstream Year 3 groups scored average mean ranks of 87.79 and 78.5, respectively, which deviated from all the other groups investigated.

Table 5: Kruskal Wallis H test results on the study level

Variable	Kruskal-Wallis H	Df	Asymp. Sig.
I am confident in my ability to succeed	50.421	4	<.001
I find it difficult to raise my opinion in discussions	3.226	4	0.521
I enjoy making new friends, maintaining good relationships with them	2.486	4	0.647
I find it difficult to adapt to change	4.282	4	0.369
I believe in learning from my mistakes	19.021	4	<.001
I prefer using proven ways of doing things to trying new ways	4.957	4	0.292
I am aware of my abilities, preferences, and behavior	1.814	4	0.77
Writing down goals is not necessary as long I know what I want to achieve	14.981	4	0.005
I am not frustrated by disappointments, and I keep on trying	2.953	4	0.566
I am comfortable when someone leads me to do some tasks	1.106	4	0.893

Table 6: Mean of selected attributes by study level.

	Entrepreneurial attributes (mean ranks in brackets)		
Study Level	I am confident in my ability to succeed	I believe in learning from my mistakes	Writing down goals is not necessary as long I know what I want to achieve
Extended Year 1	***2.62 (31.02)***	***2.95 (61.14)***	2.90 (109.83)
Extended Year 2	3.72 (108.97)	***3.44 (85.94)***	3.18 (124.58)
Mainstream Year 1	3.73 (109.95)	3.55 (102.25)	2.89 (108.96)
Mainstream Year 2	3.74 (107.89)	3.57 (101.75)	***2.50 (87.79)***
Mainstream Year 3	3.63 (100.87)	3.73 (115.49)	***2.32 (78.5)***

4.4. Differences in the perceptions of female and male students

Table 7 illustrates an analysis of differences between gender groups (male and female). It presented the results of the Mann-Whitney U test. It answered the fourth research question (RQ4), 'Is there any significant statistical difference in the perceptions of female and male entrepreneurship students?' correspond to H3, 'The distribution of perceptions among female and male entrepreneurship students is not significantly different.'

Table 7. Mann-Whitney U test results on gender

Variable	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2 tailed)
I am confident in my ability to succeed	3934.5	11195	-1.963	0.05
I find it difficult to raise my opinion in discussions	4381.5	7231.5	-0.428	0.669
I enjoy making new friends, maintaining good relationships with them	4578.5	7504.5	-0.054	0.957
I find it difficult to adapt to change	3915.5	6841.5	-1.709	0.088
I believe in learning from my mistakes	4107	11367	-1.365	0.172
I prefer using proven ways of doing things than trying new ways	3894.5	6595.5	-1.279	0.201
I am aware of my abilities, preferences and behavior	4411	11432	-0.215	0.83
Writing down goals is not necessary as long I know what I want to achieve	4432	11692	-0.185	0.853
I am not frustrated by disappointments, and I keep on trying	4453	11593	-0.027	0.978
I am comfortable when someone leads me to do some tasks	3991.5	6766.5	-1.314	0.189

Of the ten variables, only one (I am confident in my ability to succeed) presented a statistically significant difference between the two gender groups (male and female). The mean ranks (male = 106.73 and female = 93.29) of perceptions among students were significantly different between gender groups, $U = 3934.5$, $z = -1.963$, $p = 0.05$. The distribution of perceptions was not similar across males and females, which was investigated as a trait confidence. Thus, H3 was not supported. The current study broadly aligns with similar findings by Ezeuduji et al. (2025), who found no statistically significant differences in the entrepreneurial attributes investigated across gender groups.

The significance of gender and its relationship with entrepreneurial behaviors contributes to being sandwiched between contrasting opinions, findings, and theoretical propositions. The results of this study revealed that gender-based perceptions of entrepreneurial characteristics differ statistically significantly only for the trait of confidence. Thus, the study posits that male and female

entrepreneurship students have similar conceptions of their entrepreneurship attributes, suggesting that gender may not be a critical concern in designing entrepreneurship education curricula at university. Therefore, the study advocates a gender-neutral approach (Zhang et al., 2022) to entrepreneurship instruction. In any case, research reveals that the perceived imbalance in benefits of entrepreneurship and entrepreneurship education against female entrepreneurs may need to be revised. In a study investigating perceptions of entrepreneurship graduates in Zimbabwe, Jengeta (2020) found that an almost identical percentage (71% and 69%) of female and male students, respectively, expressed the adequacy of the entrepreneurship education offered at the university. Behaviorally, it has emerged that female entrepreneurs have comparable or superior competencies than male entrepreneurs, such as the capacity to develop innovative business concepts, innovate solutions, and easily adjust to unexpected changing trends (Vukmirović, 2019).

5. Discussion

The study evaluated the entrepreneurial attributes of students at a South African HEI in line with the research questions. The results confirmed elevated self-efficacy in entrepreneurial domains. These findings are consistent with previous studies (Galvão et al., 2024) and add to nuances about how entrepreneurship education can mediate students' self-efficacy perceptions (Nowiński et al., 2017) and traits such as confidence, awareness of abilities, preferences, and behavior, learning from mistakes, persistence despite frustrations, networking, adapting to change, and being creative. Farrington et al. (2012) did a follow-up to their 2001/2002 investigation, where attributes similar to those of the current study were investigated. However, they focused on three countries: South Africa, the Netherlands, and the USA.

In both studies, the South African population has consistently demonstrated entrepreneurial skills, considering the mean of greater than three on a five-point Likert scale in terms of undergraduate business students. These were commitment, a high energy level, overcoming failure, planning and perseverance, persuasion and networking, communication ability, self-confidence and locus control, initiative and responsibility, creativity and flexibility, knowledge-seeking, involvement in continuous learning, financial proficiency, and business knowledge. Moreover, entrepreneurship research has also addressed self-belief as a critical element of self-efficacy in entrepreneurship, where self-efficacy is conceived as belief in one's capacity to gather and put into practice the resources, competencies, and abilities required to attain levels of achievement (Maddux, 2016).

The positive self-perceptions of their entrepreneurial capabilities expressed by the students suggest that they are predisposed to becoming entrepreneurs if given adequate support and education. Notably, Moreno et al. (2019) also reflected high student self-belief in their innate entrepreneurial attributes. These perspectives arguably establish the enabling role of entrepreneurship education towards facilitating entrepreneurial action.

The results related to RQ2, 'Is there any significant statistical difference in the perceptions of the students on the selected entrepreneurial characteristics?' found no significant differences in the students' perceptions of the selected entrepreneurial characteristics. This suggests that students generally perceive these entrepreneurial traits similarly regardless of their background, experiences, or other factors. Moreover, such universal perception can be influenced by student beliefs that these traits are basic requirements for entrepreneurship participation. However, some studies have found that family business background can influence students' perceptions of what can bring entrepreneurial success. This raises the possibility that students might have different perceptions of the students for the selected entrepreneurial characteristics in other contexts.

Regarding the variability of student perceptions across years of study, findings revealed that entrepreneurship education positively influences certain, but not all, student entrepreneurship traits in each year of study. These results concur with Price and Ronnie (2021), who found that teaching practices and entrepreneurship curricula in South Africa shaped student perceptions differently between the first and third years of study. On analyzing gender, results showed that perceptions of entrepreneurial characteristics across gender groups were statistically significant only regarding the trait of confidence, which revealed low levels among female students. In essence, the study indicates that female entrepreneurs have entrepreneurial abilities like those of male entrepreneurs. Statistically significant differences were observed in confidence and learning from mistakes as students progressed from one level of education to another. Surprisingly, the results showed that students appear to deprioritize goal setting as they progress towards completing a qualification.

Notably, a comparable survey by Saunders (2013) found statistically insignificant differences in all (or any of) the entrepreneurial attributes investigated across the years of study. These findings confirmed that entrepreneurship education positively influences certain, but not all, student entrepreneurship traits in each year of study. Therefore, in designing entrepreneurship curricula, universities should focus on attributes with which entrepreneurship can contribute most to developing entrepreneurial readiness. As argued earlier, although entrepreneurship education transforms entrepreneurial mindsets and behaviors, students possess enduring personal and socially constructed attributes, which may be less susceptible to change and may not be significantly altered by entrepreneurship education.

The study highlights the significance of institutions providing entrepreneurship instruction and support to students to cultivate an entrepreneurial mindset and attitude. In summary, this study confirms the importance of gaining sufficient insights into the student profiles of students to inform students about their teaching and learning.

5.1. Theoretical and practical implications of the study

Considering the above-discussed findings, this section highlights the implications of the current study. Despite the positive trend confirming the presence of entrepreneurial attributes among South African higher education students, the

country continues to report low Total early-stage Entrepreneurial Activity (ETA) as reported in the Global Entrepreneurship Monitor (GEM) 2022/2023 (Hill et al., 2023), mostly below 10% since 2001. Furthermore, the GEM reports consistently high attitudes and perceptions of persistent fear of entrepreneurial failure among South Africans (Herrington & Kew, 2018), with low ETA despite the high unemployment rate. Thus, more should be done about entrepreneurial activity within and beyond HEIs.

Instead of waiting for students to graduate, institutional efforts should be made to develop their practical skills, such as through university competitions. An example of the above is the annual Entrepreneurship Development in Higher Education (EDHE) Entrepreneurship Intervarsity competition, which fosters entrepreneurial capacity among students from all 26 South African universities (Nhamoinesu & Tengeh, 2024). Such initiatives may be instrumental in translating perceived attributes into actionable experience and entrepreneurial intention.

6. Conclusion

The study aimed to profile the entrepreneurial attributes of students of entrepreneurship education at a university of technology in South Africa from a self-perception perspective. It has confirmed the existence of entrepreneurial attributes among South African HEI students across various study levels and gender groups. Students demonstrated crucial entrepreneurial traits, including confidently pursuing goals, persevering through challenges, creatively problem-solving, adapting to changing circumstances, and networking. Despite these attributes, South Africa continues to record low levels of overall early-stage entrepreneurial activity and high levels of fear of failure among its citizens. Mentorship programs and entrepreneurial incubators can also provide experiential learning opportunities. By nurturing entrepreneurship mindsets, academic institutions can equip graduates with entrepreneurial competencies to find employment and create job opportunities for themselves and others.

6.1. Recommendations

The HEIs and the government must take concrete steps to bridge the gap between students' strong entrepreneurial attributes and the low levels of entrepreneurial activity in South Africa. Entrepreneurship education providers must consider the individual goals of their students when designing their training programs, profiling individual characteristics, and determining students' entrepreneurial intentions. By identifying and acknowledging students' entrepreneurial attributes, educators can create tailor-made programs that will enhance their students' entrepreneurial competencies. Furthermore, HEIs should prioritize the development of students' practical competencies through initiatives such as competitions, which may assist in developing students' perceptions of entrepreneurial attributes into experience and entrepreneurial intention.

Additionally, entrepreneurship education should provide students with skills that align with the 4IR and graduate attributes, including critical thinking, problem-solving, and decision-making skills, as well as knowledge of risk management, financial literacy, and creativity. It should also foster creativity and

an entrepreneurial mindset, enabling students to seek and explore possibilities for personal and professional growth and development. Finally, entrepreneurship education should support students in launching ventures. Inclusive of all socioeconomic and cultural backgrounds, entrepreneurship education should be equitable and accessible to all South African students.

Considering the disconnect between self-perceptions and entrepreneurial activity rates in the country, the discussions in this study highlight a positive relationship between entrepreneurial traits and education. HEIs should administer diagnostic entrepreneurial assessments determining prospective students' entrepreneurial orientation during enrolment. Once students are enrolled, curriculum design and teaching strategies should align with and foster their entrepreneurial propensity. Furthermore, HEIs should collaborate with industry stakeholders to motivate students uncertain about entrepreneurship. Furthermore, entrepreneurs with practical experience should ideally teach entrepreneurship courses.

6.2. Study Limitations

Despite the positive findings, the study has several limitations. The generalizability of findings is limited to the one university studied and perhaps another comparable university of technology in South Africa. A larger sample size above the 203-sample used in this study can strengthen the study's validity based on larger population sampling reasons. Moreover, given the use of convenience sampling and in-person data collection, which limit control over stratification by level of study and gender representativity, future studies may benefit from stratified sampling approaches to improve transparency and validity.

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