

***Entrepreneurial Intentions of Science,
Technology, Engineering and Mathematics
Students at the University of Witwatersrand,
Johannesburg, South Africa***

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DECLARATION

I, Ntathu Mazibuko , declare that this research article is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Ntathu Mazibuko

Signed atNquthu.....

On the28..... day ofFebruary..... 2023.....

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ABSTRACT

Entrepreneurship is one of the solutions put forward to curb the rising unemployment statistics in South Africa. It is argued that Entrepreneurial Intentions are a good indicator of Entrepreneurial Activity. The study examines the relationship and influence of Entrepreneurial Self-Efficacy together with Innovation and Entrepreneurial Education on Entrepreneurial Intentions. The subject of this study involved students from the University of Witwatersrand, Faculty of Engineering and Built Environment who are studying Science, Technology, Engineering and Mathematics (STEM) courses. The study collected data from a random sample of 60 students using an adapted questionnaire. The descriptive as well as inferential statistics were used to analyse the data. The results show Entrepreneurial Education does not have significant impact on the students' Entrepreneurial Intentions, whilst Entrepreneurial Self-Efficacy and Innovation showed a positive relationship. Results also showed that high Entrepreneurial Intentions do not translate to Entrepreneurial Activity.

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"In [specific field/area], there is a pressing need to address [specific issue or challenge]. Despite [existing solutions/previous research], there remain significant gaps and limitations in our understanding of [aspect of the problem]. This research aims to [specific objectives/goals], with the ultimate goal of [desired impact or outcome]. By addressing these gaps, the findings of this study could contribute to [potential benefits or advancements] and inform future [applications/policies/strategies] in [relevant context]."

CHAPTER 1. INTRODUCTION

The South African economy is currently under severe strain with high unemployment rates, low economic growth, high inflation. The unemployment rate as at Q1 of 2022 is 34.5% and the youth unemployment at 63.9% for ages 15-24 and 42.1% for ages 25-34% (Stats SA, 2022). South Africa has a high number of unemployed graduates, the current job market is not able to absorb graduates into the workforce therefore more and more graduates find themselves unemployed with no future prospects because they expect to be employed in corporate rather than creating their own businesses. The South African government has rolled out a number of programmes promoting entrepreneurship amongst the youth like the National Youth Development Agency. Studies have shown that entrepreneurship can lead to economic growth. Naude et al., (2008) stated that there is a strong causality between entrepreneurship and economic growth in developing countries.

Entrepreneurship is a key solution to South Africa's economic woes (Maas and Harrington 2006 cited by Fatoki 2010). Creation of new businesses will boost the economy and increase employment opportunities. The theory of economic development by Schumpeter places entrepreneurs at the forefront of economic advancement, entrepreneurs take risks and are innovative (Audretsch, Keilbach and Lehmann 2006 as cited in Ramchender 2019) which leads to a competitive economy.

Global Entrepreneurship Monitor (GEM) 2019 report identified 4 key issues that have an impact on entrepreneurial attitudes and activities in South Africa. Government policies and initiatives, market openness, entrepreneurial education and training, availability of and access to finance. Entrepreneurial education is important foundation for an entrepreneur to succeed in his/her entrepreneurial ventures. Although there are a number of entrepreneurship programmes by different organisations, the education system in South Africa does not sufficiently support entrepreneurship.

This is evident in the university curricula especially for Science, Technology, Engineering and Mathematics (STEM) students. These programmes focus on technical knowledge and not business skills. It is as if STEM students are channelled to be employment seekers and not employment creators. Research by Colombo and Piva (2020) indicated a positive relationship between a non-STEM degree and entrepreneurial activity, students with both

STEM and non-STEM degree also had a higher entrepreneurial propensity. The paper further recommends that the university curricula must be designed to support entrepreneurial route for students by including economics and management courses for STEM degrees.

STEM graduates are viewed as drivers of technological innovation which has a significant impact in economic growth (Atkinson and Mayo, 2010 as cited in Breznitz and Zhang, 2020) students and ability to innovate therefore needing entrepreneurship education. Entrepreneurship and factors that lead to a person choosing the entrepreneurial route have been a focus in some studies in recent years, this exploratory study therefore seeks to investigate the inclination of STEM students in South Africa towards entrepreneurship. The research aims to determine STEM students' entrepreneurial intentions.

Whilst there is lack of prior research in this area, STEM graduates are generally the most innovative and technical oriented. The number of STEM students that have gone and created successful businesses in their fields after graduating is envisioned to be low. Gerba (2012) also concluded that students registered for business-related qualifications show a higher attraction towards entrepreneurship than those in engineering related courses (Gerba 2012 cited in Mbuya and Schachtebeck 2016).

1.1 Research objectives

South Africa has high unemployment rate leading to graduates in the STEM field finding themselves without employment at the end of their studies. Despite this, there is little research investigating the effectiveness of entrepreneurship education and alignment between entrepreneurial intent and actual behaviour among STEM students. Therefore this study aims to investigate and provide valuable insights into the relationship between these factors. The results of this study could improve entrepreneurship education activities and inform strategies to support entrepreneurial initiatives within STEM disciplines.

The objectives of this study is to explore the link between entrepreneurship education and entrepreneurial intentions for STEM students.

Objective 1 - to evaluate if entrepreneurial education can influence entrepreneurial intentions

Objective 2 - to measure the link between perceived self-efficacy and entrepreneurial intention

Objective 3 – to identify STEM student’s personal attitudes and entrepreneurial intention
Objective 4 – to measure the relationship between entrepreneurial intent and actual activity

According to Chen, Greene, and Crick, (1998) individuals may shun entrepreneurial activities not because they actually lack necessary skills but because of the strength of their belief that they do not have the capability of successfully executing entrepreneurship tasks. The significance of this investigation seek to share some light on the factors that prohibit or enable the STEM graduates from pursuing entrepreneurial acts.

CHAPTER 2. LITERATURE REVIEW

2.1. ENTREPRENEURSHIP

Naude et al., (2008) observed that the current level of entrepreneurial start-ups in South Africa are mostly opportunity driven and not necessity driven. Neck, Neck and Murray (2018) defined necessity based entrepreneurs as “individuals who are pushed into starting a business due to circumstance.” (Neck et al., 2018:117). Where else opportunity based entrepreneurs are individuals who start businesses based on their ability to “create or exploit an opportunity.” (Neck et al., 2018:117), these individuals are driven by their need to become independent and increase their income and they freely decide to enter into business unlike the necessity based entrepreneurs whose motivation might be lack of income due to unemployment.

Neck, Neck and Murray (2018) discusses seven truths about entrepreneurship and two of the truths relevant to this study is that entrepreneurship can be taught and entrepreneurship is a life skill. These authors recommend a practice based approach to teaching entrepreneurship versus the process approach (identify opportunity, understand resource requirements, acquire said resources, plan and implement) that most universities who teach entrepreneurship follow.

The practiced based approach follows the theory of effectuation by Dr Sarasvathy, where entrepreneurs starts with what you have and also entrepreneurs are able to “effect” the future by recognizing that the future is unpredictable yet controllable. Entrepreneurs need to have the mindset that emphasizes opportunities and not threats.

Dollinger (2008) indicated that aspiring entrepreneurs of this day and age are technologically precocious, that young people are well suited for entrepreneurial activity because they are immersed in technology and have internalised its power. This is especially advantageous in the context of 4IR and the rapidly growing digital economy. The traditional career path is changing and entrepreneurship is going to be the career reality for most people.

2.2. Entrepreneurial Intention

Thompson (2009) defined Entrepreneurial Intention (EI) as the “self-acknowledged conviction by a person that they intend to set up a new business venture and consciously plan to do so in the future.” (Thompson 2009 :676). Knowing the EI of the STEM students will contribute to determining how likely they are to follow the entrepreneurial career route. Yordanova, Filipe and Coelho (2020) stated that entrepreneurial intentions play a mediating role between potential antecedents such as demographics, personality traits, availability of critical resources and beliefs and the act of forming a new business.

Krueger, Reilly and Carsrud (2000) argue that predictor of whether a person can start a business is by their intention towards said behaviour and not their attitudes, beliefs, personality and demographics. These authors further state that intentions predict behaviour while attitudes predict intention. A student’s attitude towards entrepreneurship may not result in any entrepreneurial activity, but his/her attitudes may influence their intention.

Research conducted in this area shows/discusses two major theories of entrepreneurial intentions, namely Ajzen’s Theory of Planned Behaviour and Shapero’s model of the Entrepreneurial Event (Ajzen 1991, Shapero 1982 as cited in Krueger and Carsrud 1993)

Nayak et al., (2020) explained that the theory of planned behaviour(TPB) assists in research to recognize factors that can influence STEM students to pursue entrepreneurship as an alternative to formal employment. TBP is essential for assessing a person’s entrepreneurial motive and the individual’s actions are a source of purpose and motive.

Ajzen 1991 states that the entrepreneurial drive is influenced by the following three factors
1) mindset and sense of entitlement 2) social norm 3) assumed behavioural management.

These three variables impact a person's decision to take action. Innovation in an entrepreneur is a product of deliberate and expected behaviour.

The mindset of university student has a significant effect on their choice to pursue entrepreneurship as a profession and intention is a strong predictor of performance. In the 2020 GEM report, South Africa scores well below its African counterparts with TEA (Total early stage Entrepreneurial Activity) scores of 17.5% compared to similar economies.

GEM 2019 score on entrepreneurial intention was 11.9% vs actual entrepreneurial activity at 7.3%. This gap further indicates that the structural issues in South Africa are somehow preventing the actualisation of goals (starting and running a business) set by people with entrepreneurial intentions.

2.3. Entrepreneurship Education

Hypothesis 1: Entrepreneurial education has an influence on entrepreneurial intentions.

Entrepreneurship can be developed and encouraged through the function of education, entrepreneurship education provides individuals with skills to recognize opportunities (Mat, Maat and Mohd 2015)

The 2019 GEM report shows fear of failure at 49.8% of the adult population who perceive good opportunities but would not start a business. It can be argued that lack of entrepreneurship education is the reason why this adult population has this fear. Education does give confidence to one's capabilities and competencies which is required for an entrepreneur to succeed. STEM graduates are innovative and they could benefit with entrepreneurship education to become managers of businesses as well.

Yordanova, Filipe and Coelho (2020) reports that STEM students exhibit certain characteristics such as aversion to financial and bureaucracy issues, lack business management knowledge and often encounter obstacles due to their lack of entrepreneurial skills. Entrepreneurship education can therefore bring about a mind-set shift and enhance entrepreneurial intentions that influence individuals to start their own business venture. A study conducted by Iwu et al., (2016) concluded that entrepreneurship education has significant influence towards a student's decision to become an entrepreneur.

Johannisson (1991) explains that learning from entrepreneurship education occurs at different levels: - 1) know-why: which are an individual's values, attitudes and motivation 2) know-what: which is knowledge of the subject/topic 3) know-how: is abilities and skills 4) know-when: focuses on experience and intuition and 5) know-who: social skills and networking.

Barba-Sánchez and Atienza-Sahuquillo (2018) argue that EE has a positive contribution on its participants in terms of skills, know-how and better entrepreneurial attitudes but the real contribution of the course towards entrepreneurial activity remains unclear. The authors further argue that some researchers highlight motivation as important in running a business and that motivation cannot be taught.

Entrepreneurship education and innovation learning are the antecedents to develop entrepreneurial mindset and intention among students and to equip their knowledge and skills to be an entrepreneur (Bharakat et al., 2014). Therefore, entrepreneurship education across all degree offerings is very important and inevitable as one of the solutions to unemployment in South Africa.

A quantitative review of literature conducted by Martin et al., (2013) found a significant positive relationship between entrepreneurship education and perceptions of entrepreneurship, entrepreneurship knowledge and skills and entrepreneurial intentions. (Martin et al., 2013 as cited in Yordanova et al., 2020). Elective and compulsory entrepreneurship education is conducive for the development of entrepreneurial skills. Hahn et al., 2020 as cited in Yordanova et al., 2020)

The Human Resource Development Council (HRDC) of South Africa Enabling Entrepreneurship report (2014) stated that universities need to be vibrant entrepreneurship ecosystems with offerings across 3 main dimensions: academic entrepreneurship, enterprise support and entrepreneurial behaviour. (Cassim 2013 as cited in HRDC 2014 report).

The council surveyed different universities and business schools on their entrepreneurial education offerings and recommended that more investment is required to put entrepreneurship firmly onto the stage in South African Universities and that universities need to shift from offering academic entrepreneurship to being entrepreneurial universities.

Tengeh, Iwu and Nchu (2015) conducted a study on the extent to which South African Higher Education Institutions (focusing on six university of technology) have integrated entrepreneurship education in non-business related course curricula. The Faculty of Engineering was the focus of the study and it revealed that only 33% of the programmes had embedded entrepreneurship as part of curricula. The authors further recommended that government need to be involved in terms of policies to ensure that entrepreneurial education is embedded in all formal education systems to develop students' entrepreneurial capacities.

2.4 Entrepreneurial Self-efficacy (ESE)

Hypothesis 2: There is a relationship between perceived self-efficacy and entrepreneurial intention

Mainstream theories (Bandura 1997; Chen et al., 1998; De Noble et al., 1999) describe self-efficacy as a function of an individual's belief on own abilities to accomplish and achieve self-determined goals. Similarly, for entrepreneurial careers, Chen et al., described ESE "an individual's belief in his/her capability to perform tasks and roles aimed at entrepreneurial outcomes." (Chen et al., 1998:1).

ESE plays a crucial role in determining whether individuals pursue entrepreneurial careers. Bandura (1977) asserts that sources of self-efficacy can be obtained from mastery experience, vicarious experience, social persuasion, and physiological and affective states. Individuals with a "can do attitude" are likely to succeed in the start-up phase of a business.

2.5 Innovation and Creativity

Hypothesis 3: Individual innovation and creativity have an influence on entrepreneurial intentions

Innovation and creativity are expressive features of self-efficacy a" construct that measures a person's belief in their own abilities to perform on the various skill requirements necessary to pursue a new venture opportunity" (De Noble et al.,1999 :2). Research suggests that self-efficacy can predict an individual's intention to start a business because it reflects their belief that it is possible for them to do so (Piperopoulos and Dimov 2015).

Koloba, Dhurup and Radebe (2015) explained that entrepreneurs very much rely on their self-efficacy and sense of resilience especially in South Africa where conditions are unfavourable. STEM students' intentions of starting a new business could be heightened or decreased by their level of confidence in their competence to run a business. Entrepreneurial self-efficacy goes beyond the skills and knowledge of the entrepreneur but their personal belief, creativity and personal attitudes towards starting and run a business successfully. The strength of this belief is key to for students to perceive entrepreneurship as feasible (Lebusa 2011).

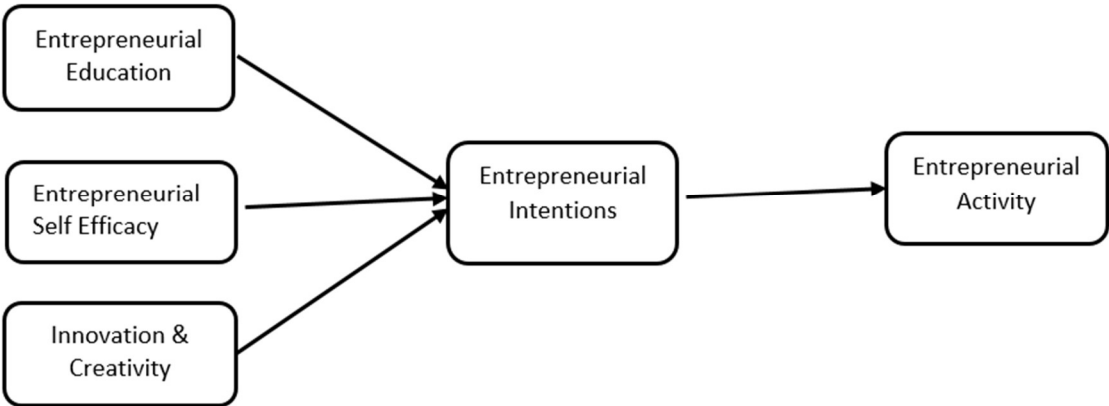
2.6. Entrepreneurial Activity

Hypothesis 4: Entrepreneurial intent has a positive relationship with and Entrepreneurial activity

Shapero's entrepreneurial event model show that perceived desirability, perceived feasibility and propensity to act all lead to intentions and intentions lead to entrepreneurial behaviour. Business founders must perceive entrepreneurship as a credible career alternative and that credibility is determined by how desirable and how feasible the business venture is perceived to be.

Krueger and Carsrud (1993) further states that external factors such prior exposure to entrepreneurial activity can influence perceived desirability and feasibility. Other external factors such as unemployment operate indirectly through attitudes towards desirability and feasibility. Refer to figure 1. below outlining the conceptual model of various constructs under investigation.

Figure 1. Conceptual Framework



Hypothesis 1: Entrepreneurial education has an influence on entrepreneurial intentions

Hypothesis 2: There is a relationship between self-efficacy and entrepreneurial intention

Hypothesis 3: Individual innovation and creativity have an influence on entrepreneurial intentions

Hypothesis 4: Entrepreneurial intent has a positive relationship with entrepreneurial activity.

The hypotheses addresses the problem statement that

CHAPTER 3. RESEARCH METHODOLOGY

The following section outlines the research paradigm guiding this exploratory study, the overall research approach, the specific methods to be employed for data collection, and analysing research data.

3.1 Research Philosophy and Approach

The entrepreneurship intentions and self-efficacy concept cannot be directly observed or measured, requiring measurable factors (Creswell 2018).

This study is conceptualized within a quantitative research framework based on the positivist research paradigm. The study will search for causal relationships among the constructs of framing this investigation namely, education/ Intention and self-efficacy as antecedents for the inclination towards entrepreneurship.

The application of epistemological approach, using the hypothetic–deductive reasoning (Creswell 2018) allows for investigation of the cause-effect relationship among factors influencing inclinations towards entrepreneurship as well as unearthing other relationships among variables pertinent in this study, for instance gender, age and race. The investigation is a non-experimental study focusing on the applied research approach, quite popular among managers and practitioners alike, as it often assists to focus the investigation to practical guidelines for implementation by various entities.

3.2. Survey Instrument

As part of the research strategy and for practicality, gathering student's opinions and percentage distributions was made possible by the survey form designed using Qualtrics. The survey link was deployed to the respondent's email addresses, based on student's voluntary participation.

Structured survey instrument was designed for collecting quantitative data, refer to **Appendix 7.1.** and consisted of a battery of sub-scales questions for each of the three constructs. With the variable measurements done on a 5 point Likert type scale, where 1= "Strongly disagree" and 5 = "Strongly agree."

The survey instrument comprised several constructs included screening respondents and a specific course enrolled, respondent's demography; and entrepreneurial activity related sections. The scale items for measuring various constructs were sourced from the literature and adapted based on previously validated studies. Namely, the adoption of the generalised self-efficacy scale by Schwarzer and Jerusalem (1995) and other scale items from Robinson (1991) as well as De Noble (1998) as well as instruments to measure the entrepreneurship domain and attitudes orientation.

3.3. Sampling Framework

The study population is limited to the WITS university based STEM students. The university database will be used to reach as many potential respondents to participate in the study. Due to the lack of accurate sampling frame, a mixture of non-probability-convenient sampling, as well as purposive sampling, was adopted.

The use of students samples in research for entrepreneurial intentions is important as the students are currently involved in career choice processes, a study of their attitudes will be beneficial (Barba-Sánchez and Atienza-Sahuquillo 2018). The inquiry as a mono-method, a cross-sectional quantitative survey completed once off by respondents. The sample offered a snapshot of students' perceptions and opinions during the survey period

Non-probability convenient sampling process' anticipated limitations pertaining to sampling error and possible inaccuracies in the generalization of the results, both reliability and validity test outcomes met the statistical assumptions. Several statistical tests were done to reduce

possible biases and inaccuracies inherent in the heterogeneous nature of students; socio-economic and demographic profiling.

3.4 Sample Characteristics

A total of 60 respondents took the survey, however only 48 completed the full survey, and the results are based on the completed forms. Out of this sample 79,2 % were African 56,3% falling in the age group 18-24 years old, and 60.4 % enrolled for undergraduate course. Both descriptive and inferential statistical analysis were used to summarise the characteristics of the sample, Inferential statistics were undertaken using regression analysis and Pearson correlations to test the hypothesis in the conceptual model, wherein the outcomes of the tests were deduced. The analysis examined the key components of the study's conceptual model. The scales were previously tested for validity and reliability, further Cronbach Alpha analysis was done to assess the internal consistency of each of the attitude components and each subscale. Correlations matrix of the construct subscales to determine cause- effect among the variables.

To test the hypothesis a regression analysis was used to determine the degree of variance within the variables, where entrepreneurial intention is the independent variable, with expected impact on both entrepreneurial education and self-efficacy as dependent variables.

CHAPTER 4. DATA ANALYSIS

This chapter presents and discusses findings from the data collected. The demographic profile of respondents, followed by regression analysis of the constructs will be presented. Sixty responses were received from the distributed questionnaire and forty-eight responses were used for the analysis as some students did not complete all relevant sections in the survey.

4.1 Demographic profiles

The main profiles investigated are age, ethnicity, current enrolment of the respondents and whether the respondents have completed any entrepreneurial courses

Table 4.1 Ethnic Group

	Frequency	Percent
African	38	79,2
Coloured	2	4,2
Indian	1	2,1
Other	1	2,1
White	6	12,5
Total	48	100

Table 4.2: Age Group

	Frequency	Percent
>56	1	2,1
18-24	27	56,3
25-36	12	25
37-46	6	12,5
47-56	2	4,2
Total	48	100

A large pool of the respondents was African at 79.2% followed by Whites at 12%. Very small representation of Coloured and Indian. This indicates the views of the African ethnic group will be dominant. The 18-24 age group is the main group represented at 53.6% of the participants followed by 25-36 group at 25%. It is valuable for this study to have participants who are classified as youth in South Africa and are most affected by unemployment.

	Frequency	Percent
Masters	9	18,8
PhD	5	10,4
Postgraduate	5	10,4
Undergraduate	29	60,4
Total	48	100

Table 4.3 Current Course Enrolment

	Employment	
	No	Yes
Current enrolment		
Masters	3	6
PhD	0	5
Postgraduate	2	3
Undergraduate	26	3

Table 4.4: Current Course and employment

status

Most of the respondents are undergraduate students (60,4%) and Masters students (18,8%). The results also showed that most of the undergraduates were unemployed while most post-graduate, masters and PhD students are currently employed.

Hypothesis 1: Entrepreneurial education has an influence on entrepreneurial intentions

Table 4.5. Entrepreneurship Course

	Frequency	Percent
No	38	79,2
Yes	10	20,8
Total	48	100

Table 4.6. Founded a business or a side hustle

	Frequency	Percent
No	23	47,9
Yes	25	52,1
Total	48	100

Table 4.7. Wish for starting own business

	Frequency	Percent
No	3	6,3
Yes	45	93,8
Total	48	100

Table 4.8. Partnered in a business with others

	Frequency	Percent
No	34	70,8
Yes	14	29,2
Total	48	100

The survey questionnaire also asked the respondents to indicate if they had previously taken any entrepreneurship courses, whether from a Youth Program, Incubator or any previous studies completed. 79,2% have not completed any entrepreneurial course previously and 52,1% have founded a business or side hustle. The results show that the lack of entrepreneurship education has not deterred the students in pursuing entrepreneurship.

Table 4.9 Owning my own business is the best alternative for me

	Frequency	Percent
Neither agree nor disagree	3	6,3
Somewhat agree	11	22,9
Somewhat disagree	3	6,3
Strongly agree	28	58,3
Strongly disagree	3	6,3
Total	48	100

When asked if they wish to start a business and be self-employed, 93.8% said yes. The response to the statement “owning a business is the best alternative for me” where 58.3% of respondents strongly agree, shows clear entrepreneurial intention. This profiling is important for understanding the entrepreneurial mindset of STEM students and behavioural patterns among the study participants.

4.1.1. Reliability and validity

To establish the reliability of the survey items, Cronbach Alpha, Pearson correlations test and inter- correlation tests were conducted. Reliability measures the consistency of questions that are designed to measure a variable. Cronbach alpha values above 0.65 indicate that the scale is reliable. The results showed a Cronbach alpha of 0,930 for entrepreneurial intentions and 0.659 for entrepreneurial self-efficacy and 0,680 for innovation and creativity scales.

Table 4.10 Cronbach Alpha test

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Entrepreneurial Intentions	0,929	0,93	8
Entrepreneurial Self Efficacy	0,666	0,659	8
Innovation and Creativity	0,67	0,68	6

A Pearson correlation between 0,50 and 0,70 indicates that there is a moderate correlation between variables. The results show entrepreneurial intentions and entrepreneurial self-efficacy are positively correlated at 0.613, entrepreneurial intention and innovation and creativity positively at 0.528 with entrepreneurial self-efficacy e and innovation and creativity also moderately positively correlated at 0.503.

Table 4.11 Pearson Correlation table

Correlations				
		ENT_INTENT	ESE	INNOV
ENT_INTENT	Pearson Correlation	1	.613**	.528**
	Sig. (2-tailed)		0	0
	N	48	48	48
ESE	Pearson Correlation	.613**	1	.503**
	Sig. (2-tailed)	0		0
	N	48	48	48
INNOV	Pearson Correlation	.528**	.503**	1
	Sig. (2-tailed)	0	0	
	N	48	48	48

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4.12 Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
ENT_INTENT	48	2	5	4,26	0,892
ESE	48	2	4	3,04	0,419
INNOV	48	2	4	3,26	0,466
Valid N (listwise)	48				

Table 4.9 depicts descriptive statistics of entrepreneurial intentions, entrepreneurial self-efficacy and innovation and creativity item scale. Entrepreneurial intentions of the students are high with a scale mean of 4,26 and standard deviation of 0.892. Entrepreneurial self-efficacy has a lower mean than that of innovation at 3.04.

4.2. Inferential Statistics

Hypothesis 2: There is a relationship between perceived self-efficacy and entrepreneurial intention

Hypothesis 3: Individual innovation and creativity have an influence on entrepreneurial intentions

One of the objectives of this research was to explore the relationship between entrepreneurial self-efficacy, innovation and creativity and entrepreneurial intentions of the respondents. A Linear regression analysis was conducted to determine if this relationship does indeed exist and how much it impacts the variables impact each other. The adjusted R square explain 41,5% of the variance in entrepreneurial intentions. The Durbin-Watson value of 2,251 is within acceptable range of 2-4 and indicates that there are no auto correlations.

ANOVA statistic shows model is a good fit and statistically significant with a P value of <,001. An increase in Entrepreneurial Self Efficacy will result in a positive increase in Entrepreneurial Intentions. An increase in innovation and creativity will also result in a positive increase in entrepreneurial intentions by 56,2%. The VIF statistics value of 1,339 which is less than 10 and condition indexes have no value greater than 30 meaning that multi collinearity is not an issue.

Evaluation of Cooks' distance shows no value greater than 3. Meaning that there were no outliers. The overall outcomes confirmed the sample has met the statistical assumptions

for a normal distribution tendency plotted with 48 entries. Therefore, ordinal regression analysis was possible, and the population distribution was normal, with each variable construct investigated independently, exploring associations as means of identifying any insightful patterns and variables for further testing the research hypotheses

The results of the regression analysis confirm that ESE and Innovation and creativity do have an influence on Entrepreneurial intentions therefore we can accept hypothesis

Table 4.10. ESE and Innovation Influence on Entrepreneurial intentions

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.663 ^a	0,44	0,415	0,682	2,251
a. Predictors: (Constant), INNOV, ESE					
b. Dependent Variable: ENT_INTENT					

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16,465	2	8,233	17,685	<,001 ^b
	Residual	20,948	45	0,466		
	Total	37,414	47			
a. Dependent Variable: ENT_INTENT						
b. Predictors: (Constant), INNOV, ESE						

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-0,576	0,823		-0,7	0,488		
	ESE	0,99	0,275	0,465	3,604	0,001	0,747	1,339
	INNOV	0,562	0,247	0,294	2,274	0,028	0,747	1,339

Hypothesis 4: Entrepreneurial intent has a positive relationship with entrepreneurial activity

It has been already established that the students' responses to the question "Do you wish to start your own business" confirms a very high entrepreneurial intention, the scale mean of 4,26 on the entrepreneurial intentions survey also confirms this (Table 4.7). However, when asked if they had founded a business or side hustle to determine the extent to which the entrepreneurial intention has resulted in entrepreneurial activity, 47,9% of the respondents said no while 52,1% had positive responses (table 4.6).

A further probe on the participants' entrepreneurial activity was done by asking whether participants have partnered in a business with others. 70,8% responded no whilst 29,2% responded positively (table 4.8). Based on these responses, there is a clear link between intention and entrepreneurial activity as proposed by hypothesis

CHAPTER 5 RESULTS AND DISCUSSION

Entrepreneurship Education

The results indicate that even though 79% of respondents had not taken any entrepreneurship courses, they had strong desires to start a business. This could be influenced by the current economic conditions in South Africa and the consistent message that entrepreneurship is the solution to the unemployment issues that South Africa is currently facing. Mueller (2011) also confirms that studies have shown a positive response in terms of entrepreneurship education's influence on entrepreneurial intention.

However, the educational variables such as which course should be taught and in what manner still needs to be explored by Institutes of Higher Education which will result in practical implications on course/curriculum design. The author recommended that entrepreneurship course should include variables like business planning, role models, entrepreneurial. Barba-Sánchez and Atienza-Sahuquillo (2018) also recommended as part of entrepreneurship training activities, showcasing start-up exhibitions with entrepreneurs in the world of engineering and technology as role models, idea generation workshops for development of innovative projects.

Entrepreneurship oriented intentions are considered to be a useful precursor to entrepreneurial action (Krueger and Brazeal 1994). These authors further discussed that intentions serve to focus on the targeted behaviour and are based on perception thus can be learned. Therefore, attitudes and beliefs can predict intentions. The results of this study shows that students do have these intentions and desires to start their own businesses. However, studies show lack of resources (financial), the South African economic climate; and maybe some of the factors that can deter students from pursuing the entrepreneurship route (Iwu et al., 2016).

Entrepreneurship self-efficacy

A high entrepreneurial self-efficacy shows that respondents are confident in their ability to run a business. The result of this study has shown that self-efficacy has a positive relationship with intentions as analysis confirmed higher self-efficacy results in higher entrepreneurial intentions which is in line with other studies (Setiawan 2014; Phetha et al., 2022; Koloba et al., 2015). However, Hsu et al., (2019) found that entrepreneurial self-efficacy is better at indicating the intentions of people who are currently satisfied with their financial situations and perceive entrepreneurship to be able to supply their personal needs. That is ESE boosts intentions when individuals have the abilities to complete the task and when the task supplies their needs. 35,4% of the respondents indicated that they are currently employed and a comparison to the unemployed respondents showed higher entrepreneurial intention, specifically on the question “nothing is more exciting for me than turning my ideas into reality”. This could be as a result of work exposure and experience gained in the field for the employed respondents therefore boosting the ability to complete the task.

Entrepreneurial Intention

In this study even though the entrepreneurial intention was high and the resulting entrepreneurial activity lower, the participants show the motivation and drive to become entrepreneurs by participating in side hustles and partnering with others in business which shows willingness to collaborate. Maresch et al (2016) speaks about the intention-action gap in entrepreneurship. A study conducted by Kautonen et al (2015) as cited in Maresch et al (2015) found that within a one year time frame on 30% of the people with high entrepreneurial intentions took steps towards entrepreneurship. The authors named fear, competing interests and uncertainty as some of the barriers in turning intention into entrepreneurial action.

5.1. Recommendations

The entrepreneurial education analysis might be improved by adding more items on the scale and defining what entrepreneurship course was attended in line with the offerings (course curriculum) at the Faculty of Engineering and Built Environment. A comparison between students who have completed the course and those who haven't can provide a clearer picture in terms of influence of education on entrepreneurial intentions.

With 52% of the respondents founded a business or a side hustle before, an indication of what kind of business or side hustle is required to determine what kind of businesses students are interested in or attracted to. Further research that distinguishes between formal entrepreneurship and informal entrepreneurship can be done and how students can continue to cultivate their entrepreneurial mindset and business acumen through participation in side hustles.

5.2. Study Limitations

The survey was distributed for a limited time and affected the response rate. The research sample was limited therefore may not accurately depict the views of the Science, Technology, Engineering and Mathematics students at the University of Witwatersrand. A larger more diverse sample could have ensured that more accurate conclusions are drawn. The use of a closed questionnaire also which made it difficult to explore any causal relationships between the constructs. The main focus of the paper was STEM students therefore this analysis does not capture the differences of entrepreneurial intentions between specific STEM degrees

5.3. Conclusion

A key to long term economic resilience is increasing the supply of individuals who see themselves as potential entrepreneurs (Shapero,1981 as cited in Kruger & Brazeal, 1994) which can result in an increase in entrepreneurial activity. This is the solution that studies are recommending to improve the economic climate in South Africa and the government is striving for by encouraging entrepreneurship initiatives.

The objective of this study was to determine the relationship and influence of entrepreneurial self-efficacy, entrepreneurship education and personal attitudes with entrepreneurial intentions. The study focused on STEM students. The findings showed that there is positive relationship between these variables. Results also showed some students have already started businesses or side hustles even though they had not received any entrepreneurial education. The economic climate, high unemployment rates together with COVID 19 pandemic saw a lot of young people taking up “side hustles”. Young people are now considering entrepreneurship as the best option for them. This is a positive direction for the country, an increase in entrepreneurial education and training, removal of entrepreneurship barriers will see an increase in entrepreneurial activity in South Africa.

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APPENDICES

Appendix A - Survey Questionnaire

Sourced from Robinson (1991), De Noble (1999) and Schwarzer and Jerusalem (1995)

Respondent Demographics

Demographics										
Gender:	Male	<input type="checkbox"/>	Female	<input type="checkbox"/>	Other	<input type="checkbox"/>				
Age Group	18 -24	<input type="checkbox"/>	25-36	<input type="checkbox"/>	37-46	<input type="checkbox"/>	47-56	<input type="checkbox"/>	>56	<input type="checkbox"/>
Nationality	African	<input type="checkbox"/>	White	<input type="checkbox"/>	Indian	<input type="checkbox"/>	Coloured	<input type="checkbox"/>	Other	<input type="checkbox"/>
Current Enrolment	Undergraduate	<input type="checkbox"/>	Post Graduate	<input type="checkbox"/>	Masters	<input type="checkbox"/>	Phd	<input type="checkbox"/>	Other	<input type="checkbox"/>
Specify course enrolled for										
I have Attended an Entrepreneurial Course	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>						
If Yes, specify the program attended	Youth Program	<input type="checkbox"/>	Course Certificate	<input type="checkbox"/>	Incubator	<input type="checkbox"/>	Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are you currently employed?	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>						
Have you founded a business or side hustle in the last 5 years	Yes	<input type="checkbox"/>	Yes	<input type="checkbox"/>						
Do you wish to start your own business or become self-employed	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>						
Have you partnered in the business with others	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>						

Instruction to Respondents: Indicate how much you agree with each of the following statements by ticking a number between " 1" and "5" where " 1" indicates that you strongly disagree with the statement and "5" indicates you strongly agree with the statement. "2 " indicates you only slightly disagree and "4 " shows only slight agreement. Do not stop to think too deeply about each question, rather work as quickly as you can, marking down your first thought. Please answer all of the questions.

Entrepreneurial Intention

1. Starting my own business is an attractive idea to me.
2. I am enthusiastic about starting my own business.
3. I spent a lot of time thinking about owning my own business.
4. Owning my own business is the best alternative for me.
5. I feel driven to make a difference in my community
6. Nothing is more exciting than seeing my ideas turn into reality
7. I am always looking for better ways to do things
8. I am great at turning problems into opportunities

Response Format on this section

1 = Definitely false, 2 = Probable false, 3= Probably true, 4 = Definitely True

Entrepreneurial Self-Efficacy

- 1 I can always manage to solve difficult problems if I try hard enough.
- 2 It is very difficult to run one's own firm
- 3 It is easy for me to stick to my aims and accomplish my goals.
- 4 I do not think I have the qualities needed for running one's own business
- 5 I am confident that I could deal efficiently with unexpected events.
- 6 For your personal financial position running your own firm is no great advantage
- 7 S/he who starts his own business runs a great risk of losing all s/he has
- 8 When I am confronted with a problem, I can usually find several solutions.
- 9 As a business owner-manager you can almost never take a day off
- 10 In order to make it as a business owner-manager you'd have to work much harder than others do

Leadership

- 1 My knack for dealing with people has enabled me to create many of my business opportunities
- 2 I believe the most important thing in selecting business associates is their competency

Innovation and Creativity

1. I feel very energetic working with innovative colleagues in a dynamic business climate,
2. I get excited when I am able to approach tasks in unusual ways
3. I feel terribly restricted being tied down to tightly organized business activities, even when I am in control,
4. I usually seek out colleagues who are excited about exploring new ways of doing things,
5. I enjoy being the catalyst for change in business affairs,
6. I always follow accepted business practices in the dealings I have with others.
7. I rarely question the value of established procedures.