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Student entrepreneurship competency and mindset: examining the influence of education, role models, and gender

Khaula Alkaabi^{1*} and Salieu Senghore²

*Correspondence:
khaula.alkaabi@uaeu.ac.ae

¹ Department of Geography and Urban Sustainability, and Human Capital Research Center, United Arab Emirates University, P.O. Box 15551, Al Ain City, United Arab Emirates

² College of Education, United Arab Emirates University, Al Ain, United Arab Emirates

Abstract

This research aims to explore the interplay among entrepreneurial education, role models, and gender on students' entrepreneurial competence and mindset. Using purposive sampling, 306 participants enrolled in entrepreneurship and innovation-related courses at UAEU completed an online survey. The research used statistical analyses, including Spearman's Rank Correlations, Cramer's V correlation, Mann–Whitney *U*, and multiple linear regression, to explore variable relationships. Findings indicate that access to entrepreneurial role models is associated with higher competence, emphasizing resource mobilization and fostering a growth mindset. Active engagement in entrepreneurship courses correlates with enhanced innovative thinking and networking. Despite gender-based disparities, statistical analysis indicates minimal impact on students' ability to generate novel business ideas. This study contributes insights to entrepreneurship education literature, offering practical implications for educators and institutions.

Keywords: Entrepreneurial competency, Role models, Entrepreneurship education, Gender, Mindset development, UAE

Introduction

The study of entrepreneurial education and mindset has attracted numerous researchers' attention. Globally, entrepreneurship education has rapidly expanded. This quick expansion was accelerated by the widespread acceptance of entrepreneurship as a primary factor in economic growth and job creation (Uleanya, 2020; Alkaabi & Ramadani, 2023; Ramadani et al., 2023; Chin et al., 2023; Rwehumbiza and Hyun 2024). Thus, governments are eager to provide support and fund the development of new entrepreneurship programs and infrastructure (Leitao & Baptista, 2009; Alkaabi, 2020, 2021). However, earlier studies, such as Duval-Couetil (2013), contend that assessing entrepreneurship education could be challenging since it is a relatively new area with ongoing conceptual and methodological debate (Alkaabi & Ramadani, 2022; Alkaabi et al., 2023). Furthermore, researchers pointed out that it is challenging due to the lack of validated instruments or assessment processes across programs. Nonetheless, having standardized and

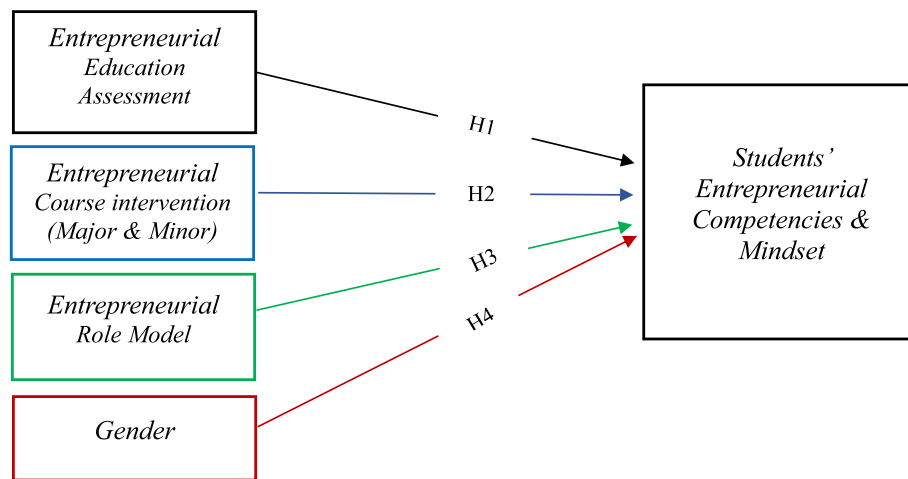


Fig. 1 Research model

best assurances of learning (AoL) practices in place could minimize these challenges (Fig. 1).

It is common for accredited degree programs to measure individual-level assurances of learning (AoL) outcomes. The most common way to integrate learning into courses is to use graded assignments to track how well students meet learning outcomes for knowledge and skills and then use that information to improve the program. The ability to conduct continuous process improvement has been shown to be restricted by this method's high cost and subjectivity. Additionally, there is a substantial gap in the literature regarding the evaluation of entrepreneurial education. In their systematic review of 159 published articles, Nabi et al. (2017) wrote that few studies directly discuss entrepreneurial education in higher education. They found that research on the effects of entrepreneurial education is still mainly focused on short-term and subjective outcome metrics and tends to provide an insufficient explanation of the actual pedagogies under study. Thus, the authors called on future researchers to investigate the impact of entrepreneurial education at the university level. This future research may involve, for instance, focusing on effect indicators related to the intention-to-behavior transition and using novel impact indicators connected to emotion and mindset. Impact, which is defined as changes observed as a direct result of educational activity at various levels, is a problem related to evaluation. A review from the European Commission (2012) shows that entrepreneurial education is efficient and noticeable at various levels. Like other types of education, it impacts the learner, the institution, the larger economy, and the entire society.

In response to the above call, this study aims to assess the impact of students' gender, the number of entrepreneurial courses they have taken, and the number of entrepreneurial role models they have on their entrepreneurial education, aptitude, and mindset using nine entrepreneurial competency and mindset indicators:

1. *Ideas and opportunities (IO) indicator*: It measures students' aptitude to generate creative business ideas and spot opportunities

2. *Resources (R) indicator*: It gauges the extent to which students believe in their motivation or ability to mobilize and manage financial, economic, and social capitals for their businesses
3. *Into action (IA)*: It measures to what degree students think they can initiate actions that create value, take up business challenges, manage risk and uncertainty.
4. *Adaptability (A)*: It determines to what level students think they can deal with sudden surprises and changes, work under stress, or lead programs of change.
5. *Entrepreneurial growth mindset (EGM)*: It gauges students' readiness to embrace challenges and criticisms to grow. Also, how much the success of others inspired them.
6. *Problem-solving attitude (PSA)*:
 7. It gauges how best students believe they can identify and appropriately analyze problems, differentiate relevant from irrelevant information, or find best solutions involving others.
8. *Critical and analytical thinking (CAT)*: It measures students' aptitude to deduce conclusions from information, make correct inferences from data, or understand when conclusions/claims are justified or not.
9. *Business collaboration (BC)*: It gauges students' readiness to collaborate and utilize resources such as coworking space, business incubators, or innovation labs to grow their start-up businesses.
10. *Business Networking (BN)*. It assesses students' rating perception of their networking competency with local, regional, and global businesses (online and offline).

This quantitative study employs a purposive sampling approach to collect data from students at the United Arab Emirates University (UAEU) for hypothesis testing. The utilization of quantitative surveys facilitated the attainment of a larger student sample, with the expectation that the findings can be generalized to a broader population. The decision to focus on UAEU is driven by its significance as a representative educational institution in the region, allowing insights that may have broader implications. The subsequent phase explores the impact of gender on entrepreneurial development, followed by a comparison of how learning and competence differ between men and women. The study aims to provide a comprehensive framework for assessing students' entrepreneurial competency, considering pedagogical approaches, course materials, and gender diversity effects. This framework can inform the development of future course materials to enhance students' entrepreneurial knowledge, competency, and mindset.

To get more insight into this study's objective, the authors ask the following research questions:

Research questions

When and how entrepreneurial education assessment leads to entrepreneurial competency and mindset.

Sub questions

1. To what extent do entrepreneurial courses (major and minor) affect UAEU students' entrepreneurial competencies and mindset.
2. Does an entrepreneurial role model relate positively to UAEU students' entrepreneurial competency and mindset?
3. What are the underlying mechanisms between gender and UAEU students' entrepreneurial competence and mindset?

The subsequent paragraphs include a review of the literature and the development of a hypothesis, followed by research method and study design, the analysis of the data and the results, a discussion of the research, and then the conclusion, limitations, and study implications.

Literature review

This review uses a thematic assessment approach to presents arguments and evidence related to developing and assessing students' entrepreneurial competency and mindset. The review further expounded on some of the parameters (such as entrepreneurial courses, role model, gender etc.) that potentially affect students' development of entrepreneurial competence and mindset. Here our definition of entrepreneur is not limited to personalities or other natural qualities, but it includes entrepreneurial behaviors and attitudes.

Entrepreneurial education assessment

Globally, entrepreneurship education has rapidly expanded. This quick expansion is fueled by the widespread acceptance of entrepreneurship as a key factor in economic growth and job creation (Uleanya, 2020). Assessment educational or student outcomes is defined as the systematic process of gathering data, examining it, and using it to make views and judgments about students' performances and accomplishments as well as potential areas for improvement in their learning and development (Palomba & Banta, 1999; Pellegrino et al., 2011). With the help of assessments, educators may determine whether the entire curriculum makes sense and whether students have the values, knowledge, and abilities required of graduates. Based on his study's findings, Uleanya (2020) recommends that when creating and planning the curriculum for entrepreneurship education, it is important to get input from all relevant parties, including entrepreneurs.

Draycott and Rae (2011) added that while evaluating enterprise education in schools, the following criteria should be taken into consideration: (1) What must be assessed, (2) Where does the learning come from, and (3) What techniques are available for assessment. In terms of what to evaluate (1), learning outcomes are challenging to analyze because they are either too general or too specific. In this regards, previous studies (Duval-Couetil, 2013; Fayolle, 2013; Mwasalwiba, 2010) argued that since entrepreneurship education is a relatively new field with ongoing conceptual and methodological contention, assessing it can be particularly challenging. It is also thought to be complex

because there isn't agreement on the learning outcomes, there aren't many examples of widely used, validated instruments or assessment protocols across programs, and it's challenging to standardize assessment because of the diversity of the programs and students involved. So, allowing students to determine the outcomes while receiving guidance from the instructors could be a viable alternate option.

Nonetheless, efforts have been made to gauge the effects of tertiary entrepreneurship education on students' entrepreneurial performance. For instance, Mwasalwiba (2010) evaluated how tertiary entrepreneurship education affected students. He observes that the selection of success indicators frequently results in findings that are biased in favor of learning outcomes connected to entrepreneurship. The creation of new firms is the most important criterion for success, followed by academic achievement and changes in the students' perspectives on entrepreneurship in terms of interest, attitudes, self-confidence, self-efficacy, and abilities. When opinions are closely examined, most questions focus on students' intentions to find their own businesses, with profit being the primary motivation. Likewise, an overview of assessment techniques used in tertiary entrepreneurship education is given by Pittaway and Edwards (2012). Even while the programs under investigation are more concerned with making money than with entrepreneurship in general education, the methodology they employ provides insight into evaluation procedures, particularly in the U.S. and the U.K. Regarding the role of institutional ecosystem, Mukesh and Rajasekharan Pillai's (2020) study suggests that effective entrepreneurship education (EE) is influenced by entrepreneurship promotion activities and institutions' attitudes towards entrepreneurship.

Researchers should keep in mind the various forms that entrepreneurial education can take to comprehend assessment practice since each form has a particular set of learning outcomes and necessitates a different kind of evaluation (Pittaway & Cope, 2007). According to Gibb (2002) and Lackeus (2015), entrepreneurial programs can be classified into four approaches: 'about', 'for', 'through' and 'embedded'. 'About' approaches are theoretical and guided by content; the aim is to present a general understanding of entrepreneurship. 'For' approaches are occupation-focused and aim to equip aspiring businesspeople with the necessary expertise. 'Through' approaches are frequently hands-on, with the goal of experiencing a true entrepreneurial learning process in "safe" circumstances. The 'through' approaches are helpful to all students at any educational level, whereas the 'for' and 'about' approaches are convenient for a subgroup of secondary and tertiary students who intend to become entrepreneurs (Lackeus, 2015). In "embedded" techniques, entrepreneurship is taught alongside other non-business topics with the goal of preparing students with entrepreneurial knowledge and experience pertinent to their field of study (Pittaway & Edwards, 2012).

Entrepreneurial courses and students' entrepreneurial competencies & mindset

Over the past years, higher education institutions have shown a great deal of interest in the teaching of entrepreneurship as the impact of entrepreneurship on higher education institutions became more obvious. Thus, numerous programs have been suggested. For instance, there are almost 2200 courses, 1600 institutions with entrepreneurship programs, and 277 endowed posts in the USA alone (Kuratko, 2005; Pittaway et al., 2011).

Several specialized programs for the teaching of entrepreneurship have been developed, particularly as postgraduate courses in innovation and entrepreneurship and as a supplement to conventional Master of Business Administration (MBA) degrees for management students. Izquierdo and Buyens (2008) observe that the majority of study has concentrated on audience, pedagogical, and course content aspects. While some researchers (Almeida & Amaral, 2019) stipulate that students with multidisciplinary competencies should enrol in entrepreneurship courses, others (Izquierdo & Buyens, 2008) contend that a course's performance can be evaluated by the competencies students acquire throughout a learning intervention. Only by assessing the effectiveness of these courses can researchers be certain that students are adequately prepared for the obstacles they will face in the workforce, whether in the management of a business or project or through the launch of a start-up (Almeida, 2020).

According to Gibb (2002) and Lackeus (2015), entrepreneurial programs can be divided into four categories: "about," "for," "through," and "embedded." In this regard, Pittaway and Edwards (2012) discover that most of the courses they examined used "about" forms, while only 1% used "through" forms and 3% used "embedded forms." This finding has the important implication that the majority of the reviewed courses do not adequately prepare the students for entrepreneurial endeavors. Instead, they want to educate people and help them understand entrepreneurship. 60% of the time, the basis for "about" sorts of entrepreneurship training is provided by learning outcomes like knowledge and comprehension.

On the other hand, there have been numerous efforts to pinpoint the various entrepreneurship sub-competences. Before moving further, it is crucial to clarify the usage or meaning of the term "competence" in the literature. Le Deist and Winterton (2005), Khan and Ramachandran (2012), and Ustav and Venesaar (2018) all use the term "competency" for a specific area of the field, while Mets et al. (2022) use the term "competence" to refer to a more comprehensive set of learning outcomes—skills, knowledge, and attitudes. Mitchelmore and Rowley (2010) define entrepreneurial competences as a particular set of skills important to the practice of successful entrepreneurship.

For a general entrepreneurial competence, Schelfhout et al. (2016) include creativity, initiative-taking, problem-solving ability, performance orientation, and risk-taking ability, whereas Oosterbeek et al. (2010) employed 10 characteristics to measure entrepreneurial competence. Ferreras-Garcia et al. (2019) note that despite past research on entrepreneurship competence, it is still challenging to come up with a specific description. The European Commission, which supported an initiative to create a framework for entrepreneurship skills, acknowledged this issue as well. Due to this, the EntreComp framework was created (Bacigalupo et al., 2016). Morris et al. (2013) divided entrepreneurship competences into a variety of partially overlapping subgroups, including functional (such as marketing, sales, management, etc.), cognitive (such as knowledge, conceptual ability), personal and personality (such as commitment, perseverance, competitiveness, and ethics), and activity-based (such as starting a business, obtaining funding, and organizing).

Despite researchers having employed a variety of approaches to test target competencies both before and after a course or program intervention, evidence has indicated positive benefits on students' development of entrepreneurial competence. For example,

Izquierdo and Buyens (2008) found that a constructivist action-oriented educational method has a favorable effect on undergraduate students' development of EC. The results also show that after the course, students' self-assessments of their entrepreneurial self-efficacy were higher. This finding corroborates with Almeida (2020), who observed that students in management exhibited a higher level of financial and economic literacy since they discussed this topic in the context of other courses, however computer science students shown a superior capacity to offer new business concepts due to their greater technical understanding in the sector. Likewise, Bikse and Riemere (2013) found that Latvia has a unified system of methodological materials that has been developed in four subject areas and can help students develop their entrepreneurial competences.

Entrepreneurial role model and students' entrepreneurial competencies

Joensuu-Salo (2022, p. 291)¹ defined an entrepreneurial role model as "someone in the close family (parents or siblings) working as an entrepreneur". By this definition, siblings can serve as role models for entrepreneurship as well. Gibson (2004) argues that a role model is much more than just an example of behaviour to imitate; it also refers to the cognitive frameworks developed by the individuals who create their ideal, maybe in light of their own developmental needs and objectives. Alkaabi et al. (2023) finds a positive impact of entrepreneurial ecosystem pillars on family business performance in the UAE, with no moderating effect from universities on this relationship. Likewise, Elmassah et al. (2022) found that risk-taking capability (personal factor), relationship with business partners and availability of funds (business factors) significantly impact the success of ethnic entrepreneurship in the UAE. A relevant study in the Asian context added that factors such as capital acquisition, employment, financial problems within the family, and available opportunities in the market play a significant role in the decision-making process of Asian immigrants who want to become entrepreneurs (Sabary et al., 2023).

Numerous empirical studies have supported the general positive effect of role models on entrepreneurial intentions (Chlosta et al., 2012; Laspita et al., 2012; Liñán & Fayolle, 2015; Urbano et al., 2011). Additionally, findings from Joensuu-Salo (2022) demonstrate a positive relationship between a student's entrepreneurial competences and having an entrepreneur in the family members. This backs up the claims made by Joensuu-Salo et al. (2021), who contended that exposure to an entrepreneurial environment throughout adolescence can influence a person's entrepreneurship skills, positive attitudes toward a future in entrepreneurship, and self-belief. Similar findings were revealed by Karimi et al. (2014). Joensuu-Salo et al. (2015) pointed out having a father who is an entrepreneur has a greater influence on a person's entrepreneurial goals than having a mother who is an entrepreneur. However, the influence of parental role models may be influenced by personality traits (Chlosta et al., 2012) and may be mitigated by factors such as attitudes, and self-efficacy (Nowinski & Haddoud, 2019) as well as gender (Moreno-Gómez et al., 2020). As observed, most of the studies cited above focused on the impact of role models on entrepreneurial intentions, instead of entrepreneurial competence.

¹ Page 291 of the Proceedings of the 17th European Conference on Innovation and Entrepreneurship, ECIE 2022.

Nevertheless, despite the studies listed above which shown the positive impact of role models, several works failed to demonstrate this beneficial effect. For instance, a review by Zapkau et al. (2017) acknowledged conflicting results. Moreover, neither Gird and Bagraim (2008) nor Brenner et al. (1991) were able to prove a causal relationship between exposure to entrepreneurial role models and greater entrepreneurial intention. According to research (Buunk et al., 2007; Laviolette et al., 2012), the only role models that can improve motivation, identification, and proactive professional behaviour are those who have achieved success. Likewise, only positive parental role models who attained success were able to raise perception of attractiveness and practicality (Criaco et al., 2017).

Gender and students' entrepreneurial competence and mindset

In addition to physical and psychological differences, men and women also differ socially. Evidence shows that in the past, this differences in social construct have caused women to be excluded from job activities. Not only due to the types of labour women could perform, but the positions also they could hold, and the pay they could earn—all of which are often lower than those of men (Crofts & Coffey, 2017; Moreno-Gomez & Calleja-Blanco, 2018). In developed, prosperous western nations like Australia, New Zealand, the UK, and the US, women continue to have lower employment participation rates than males do (Cuervo & Wyn, 2012; England, 2010; Esping-Andersen, 2009; Organisation for Economic & Co-operative Development [OECD], 2013; Patterson & Forbes, 2012). Contrarily, findings suggest that the presence of women in corporate governance positions is positively associated with business performance in the context of firms' profitability. In other words, firms that include women on their boards outperform those that don't (Kiliç and Kuzey (2016); Lückcrath-Rovers, 2013; . For example, Schwartz Ziv's (2017) concluded that boards with three or more women on them perform better financially and have more engaging, productive board meetings than boards with two or fewer women.

Male participation in entrepreneurship is much higher than female participation globally. According to Meunier et al. (2022), the number of female entrepreneurs is generally lower than that of male entrepreneurs in all three categories—owners of limited liability companies, directors of limited liability companies, and sole proprietors. Men outnumber women as limited liability company owners and managers across all economies. On average, women make up 1/4 of new business owners and directors, compared to men, who make up 3/4. Although the reason why women tend to start less new firms than males is still unclear, the literature suggests that the three primary explanations can certainly be used to explain this occurrence—i.e., the individual, the environment, and the interaction between them – (Moreno-Gómez et al., 2020). Studies have shown, according to the individual approach, that there are disparities between essential psychological components of the personalities assumed by men and women, and that these aspects are directly tied to the entrepreneurial intention. Regarding the environmental approach, some study from numerous nations reveals that the absence of other employment opportunities, family obligations, or life fulfilment is what motivates women to pursue entrepreneurship (Klyver et al., 2013). This is consistent with a recent study by Manishimwe et al. (2023) who found that women entrepreneurs are influenced by

institutional (regulatory, normative, and cognitive) factors like family pressure and support, economic development, skills, gender equality, experience, and education. Another latest research by Li and Setiawan Sanusi (2023) showed that female entrepreneurs who are motivated by pull factors prioritize non-financial performance, while those motivated by push factors prioritize financial performance.

On the other hand, some researchers have highlighted two significant obstacles that prevent women from engaging in entrepreneurial activity in an economy: the first is societal prejudice when it comes to job or business activity (Estrin & Mickiewicz, 2011), and the second is the absence of regulation and low political engagement that would assist women in the job market or business formation (Goltz et al., 2015). With respect to gender and entrepreneurship issues, the interaction between individual and environmental approach suggests that the social construction of women's role has limited women to domestic and family responsibilities, creating a major societal and cultural barrier that hinders society from viewing women as competent of starting and running their own businesses. This has had a negative effect on women's self-confidence, attitudes, and intention to devote their lives to start and run their own enterprises (Klyver et al., 2013). It is worth to mention that Laspita et al. (2012) highlighted that entrepreneurial fathers and mothers have various influences on their male and female children, and the scope and timing of parental entrepreneurial activity during the life course of their kids matter.

Research methodology

Epistemological assumption

A postpositivism is used to guide this study's processes and to make inquiry that satisfies the aim of the study (Creswell & Plano Clark, 2018). A postpositivist worldview is associated with quantitative methods where researchers make assertions based on identifying correlations between variables and testing hypotheses.

Research design

This study uses a purposive sampling ($N=306$) quantitative research design. Data was collected via online Google form survey. Williams (2007) stated that the goal of quantitative research is to collect evidence that can be measured and analyzed statistically to support or refute different claims about knowledge. With a quantitative research method, a researcher can get results by quantifying and analyzing data. It involves using numerical data and analyzing that data using statistical techniques to address research problems (Roni et al., 2020).

Hypotheses development

Based on the findings in the literature and guided by the research objectives, this study proposes the following hypotheses:

Hypothesis 1: (Entrepreneurial Education Assessment)

- Null Hypothesis (H0): *There is no significant relationship between entrepreneurial education assessment and students' entrepreneurial competence and mindset.*

- Alternative Hypothesis (H1): *Entrepreneurial education assessment has a positive relationship with students' entrepreneurial competence and mindset.*

Hypothesis 2: (Entrepreneurial courses)

- Null Hypothesis (H0): *Entrepreneurial courses have no significant influence on students' general entrepreneurial competences.*
- Alternative Hypothesis (H1): *Entrepreneurial Course intervention (major or minor) has a positive impact on students' general entrepreneurial competences.*

Hypothesis 3: (Entrepreneurial role model)

- Null Hypothesis (H0): *Entrepreneurial role model has no significant association with students' entrepreneurship competence & mindset.*
- Alternative Hypothesis (H1): *Apparently, there is a positive association between entrepreneurial role models and students' entrepreneurship competence & mindset.*

Hypothesis 4: (Gender)

- Null Hypothesis (H0): *There is no significant difference between men and women in terms of entrepreneurial competence and mindset.*
- Alternative Hypothesis (H1): *Men have higher entrepreneurial competence and mindset than women.*

The pictorial representation of the hypotheses is illustrated in the figure below.

Sampling

The quantitative part uses a purposive sampling technique. In purposive sampling, the researcher decides what information is necessary to have and then searches for those who can and are ready to provide it to the best of their ability or experience (Bernard, 2017; Lewis & Sheppard, 2006). Participants in this study's survey includes UAEU students ($N=306$) across all colleges who have taken or will take courses (major or minor) related to entrepreneurship and innovation during their undergraduate or postgraduate studies. An online survey was used to collect responses from students across different colleges from January to April 2023. Out of the 332 students who received the link, 331 completed the online survey with no missing data giving a participation rate of 99.7%. However, 25 responses were removed from the data because they were found to be monotonous,² resulting in a final sample size of ($N=306$).

Distribution of the sample (Demographic statistics)

The demographic data for this study includes gender, college, length of time in the program, age, and nationality of the participants. As shown in Table 1, there were 7.5% male students and 92.5% female students. The online survey received responses from 97.6%

² No variations in response, such as when a respondent selects "5" for each question on a five-point scale.

Table 1 Demographic statistics

Measure	Category	Number	Percentage (%)
Gender	Male	23	7.5
	Female	283	92.5
College	CAVM	12	3.9
	CBE	34	11.1
	CEDU	12	3.9
	COE	42	13.7
	CHSS	85	27.8
	CIT	68	22.2
	COL	11	3.6
	CMHS	8	2.6
	COS	34	11.1
Year in the Program	First Year	49	16.0
	Second Year	79	25.8
	Third Year	88	28.8
	Fourth Year	58	19.0
	Fifth Year	24	7.8
	Sixth Year	4	1.3
	Others	4	1.3
Age (Years)	Below 20	140	45.8
	21–25	162	52.9
	26–30	3	1.0
	31–35	1	0.3
Nationality	Emirati	299	97.7
	Non-Emirati	7	2.3

of Emirati students and 2.4% of non-Emirati students. Out of the nine colleges, 27.8% of students were from the College of Humanities & Social Sciences (CHSS), 22.2% from the College of Information Technology (CIT), 13.7% from the College of Engineering (COE), and 11.1% from the College of Business and Economics (CBE). The least number of students (2.6%) were from the College of Medicine & Health Science (CMHS). Among the participants, 28.8% were in year three of the program, 25.8% in their second year, 19.0% in year four, 7.8% in their fifth year, 1.3% in year six, and the remaining 1.3% consists of students in “others”. Most of the respondents (52.9%) belonged to the age group between 21 and 25, 45.8% were below 20 years of age, 1.0% were between 26 and 30 years of age, and only 0.3% belonged to the age group between 31 and 35.

Instrument

The study used an online survey with a questionnaire created by the researchers to answer the research questions. Roopa and Rani (2012) wrote that participants are given a well-designed and organized questionnaire to complete to gather data about their age, gender, occupation, level of education, and income, as well as other relevant variables. The overall survey scales for the study consist of 43 items, excluding the demographic and the general entrepreneurial knowledge (GEK) sections. The demographic section has 8 questions (i.e., QA1 to QA8), such as gender, department, major, college, nationality etc., while the general entrepreneurial knowledge (GEK) section has 7 questions

Table 2 Description of the 9 constructs of this study

No	Construct	Item	Source
1	IO	10	<ul style="list-style-type: none"> Almeida's (2020) EntreComp framework Authors Entrepreneurial alertness scale (EAS) by Tang et al. (2012)
2	R	5	<ul style="list-style-type: none"> Politis et al. (2012) Authors Almeida's (2020) EntreComp framework
3	IA	8	<ul style="list-style-type: none"> Almeida's (2020) EntreComp framework Bolzani and Luppi (2021) Competency scale of Morris et al. (2013)
4	A	4	<ul style="list-style-type: none"> Bolzani and Luppi (2020)
5	EGM	4	<ul style="list-style-type: none"> Authors
6	PSA	3	<ul style="list-style-type: none"> Authors
7	CAT	3	<ul style="list-style-type: none"> Authors
8	BC	3	<ul style="list-style-type: none"> Authors
9	BN	3	<ul style="list-style-type: none"> Authors

(from AQ9 to AQ15) developed by the authors. The GEK questions seek to capture the students' entrepreneurial background and overall knowledge and industrial experience.

In line with our research questions and hypotheses, 9 constructs were identified to measure students' entrepreneurial education, competency, and mindset. In other words, 9 constructs were created using the 43 items as the study's variables. The nine variables are: ideas and opportunities (IO) comprising of 10 items, resources (R) with 5 items, into action (IA) has 8 items, adaptability (A) and entrepreneurial growth mindset (EGM) each has 4 items, problem-solving attitude (PSA) consist of 3 items, critical and analytical thinking (CAT) also has 3 items, Business collaboration (BC), and Business Networking (BN) each has 3 items. The Likert scale of five-point items, where one represents strongly disagree and five strongly agree was used to measure 7 (i.e., IO, R, IA, A, EGM, PSA, and CAT) of our 9 constructs. Similarly, the Likert scale of five-point items, where one represents very unlikely and five very likely was used to measure BC, and where one represents very poor and five very good was used to measure BN.

The 10 items of the IO construct seek to measure students' aptitude to generate creative business ideas and spot opportunities, the first five items (BQ1 to BQ5) of the IO were sourced from Almeida's (2020) entrepreneur competency (EntreComp) framework (see Table 2), BQ6 and BQ7 items were developed by the authors, and BQ8, BQ9, and BQ10 items were extracted from the entrepreneurial alertness scale (EAS) by Tang et al. (2012). Item 1 (CQ1) was extracted from Politis et al. (2012) and item 2 (CQ2) of the R construct was developed by the author while the remaining 3 items were extracted from Almeida's (2020) EntreComp framework. The R construct gauges the extent to which students believe in their motivation or ability to mobilize and manage financial, economic, and social capitals for their businesses. The IA construct measures to what degree students think they can initiate actions that create value, take up business challenges, manage risk and uncertainty. The first 6 items (DQ1 to DQ6) of the IA construct were sourced from Almeida (2020), DQ7 and DQ8 were extracted from Bolzani and

Table 3 KMO and Bartlett's Test

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.929
Bartlett's Test of Sphericity	Approx. Chi-Square	7052.531
	df	946
	Sig	< 0.001

Luppi (2020) and the competency scale (CS) of Morris et al. (2013) respectively. As for the A construct, it determines to what level students think they can deal with sudden surprises and changes, work under stress, or lead programs of change. The four items of the A construct were sourced from Bolzani and Luppi (2021). The four items of the EGM construct assess students' readiness to embrace challenges and criticisms to grow, while PSA's four items determine how best students believe they can identify and appropriately analyze problems, differentiate relevant from irrelevant information, or find best solutions involving others.

The seventh construct of this study (CAT) gauges students' aptitude to deduce conclusions from information, make correct inferences from data, or understand when conclusions/claims are justified or not. BC's 3 items assess students' readiness to collaborate and utilize resources such as coworking space, business incubators, or innovation labs to grow their start-up businesses, and BN's 3 items measure students' rating perception of their networking competency with local, regional, and global businesses (online and offline). In essence, the items that composed of the 9 constructs were extracted from Almeida's (2020) EntreComp framework, the entrepreneurial alertness scale (EAS) by Tang et al. (2012), Politis et al. (2012), Bolzani and Luppi (2021), the competency scale of Morris et al. (2013), and some items were developed by the authors.

Data collection procedure

The survey was conducted online through Google Forms and distributed to participants. The authors chose Google Forms because it was free, more convenient to use, and allowed data outputs in formats that made analysis easier (Cohen et al., 2007). There are nine sections in the survey questionnaire. After giving written consent on the first page, participants move on to a page with demographic information. The variables of this study, such as ideas and opportunities, resources, adaptability, etc., are measured using a range of instruments. Apart from the demographic and GEOE part of the questionnaire, the Likert scale of five-point items, where one represents strongly disagree and five strongly agree, was used to measure the variables. To increase responses, a reminder was sent after a few weeks. The questionnaire was distributed to UAEU students via email and a WhatsApp group. Each study participant was given information about the study's objectives. Also, they have the option to participate or withdraw before any data is collected. Participants were assured of confidentiality, anonymity, and privacy. Also, there was no mistreatment, harm, or violation of the respondents' rights in relation to the study. Before conducting data

Table 4 Reliability statistical test

No	Variable	No of Items	Cronbach's Alpha (α)
1	IO	10	0.896
2	R	5	0.832
3	IA	8	0.858
4	A	4	0.776
5	EGM	4	0.823
6	PSA	3	0.802
7	CAT	3	0.831
8	BC	3	0.766
9	BN	3	0.825
Total	9	43	0.823

analysis and interpretation, the participant identification was deleted. The respondents were given three weeks to complete the questionnaire.

Validity and reliability tests

Validity test Factor analysis was used to assess the construct validity of the study, which was considered the preferred measurement technique (Cavana et al., 2001, as cited in Li & Setiawan Sanusi, 2023). The analysis produced a Kaiser–Meyer–Olkin (KMO) score of 0.929 (refer to Table 3), which suggests adequate and acceptable sampling. Also, the appropriateness of factor analysis for the data was confirmed by the statistically significant results of the Bartlett test of sphericity ($p < 0.001$). These findings imply that the items supported their specific constructs and were unique from one another.

In addition, the questionnaire for this study was given to research experts to evaluate its construct and content validity. The experts who received the questionnaire validated it by providing feedback and suggestions on the relevance, consistency, and readability of the questionnaire. The experts' valuable feedback and suggestions helped rearrange several items for clarity and simplicity. The experts' opinions and comments were also helpful in choosing the questions for each area of study. Moreover, to maintain the content validity of the instrument, relevant items, or constructs from validated scales of previous studies (e.g., Bolzani & Luppi, 2021; Morris et al., 2013) related to entrepreneurship were incorporated in the survey questionnaire.

Reliability test Reliability measures the internal consistency of the constructs. Cohen et al. (2007) stated that an alpha value greater than 0.6 is a generally accepted standard for reliability. According to Hair et al. (2013) if the reliability coefficient (Cronbach's alpha) value exceeds 0.70, a construct is considered reliable. In this study, Cronbach's Alpha was used to assess the constructs' reliability. The results (see Table 4) showed that the scales for each of the nine variables have been found to be reliable. Furthermore, the total Cronbach's Alpha value for all 9 constructs in this study was 0.82, which surpasses the recommended threshold of 0.70 suggested by Hair et al. (2013). This indicates the strong reliability of the measures.

Quantitative data analysis

Analysis and interpretation The data was analyzed using IBM's Statistical Package for the Social Sciences (SPSS) version 26. First, tests for demographics, reliability, and descriptive statistics were performed. Next, Shapiro–Wilk and Kolmogorov–Smirnov tests were used to check the normality distribution of the data set at 5% significance level. In every instance of the normality test, the test results showed that the p -value was below (0.05), indicating a non-normal distribution. Thus, the researchers decided to conduct a non-parametric test. Spearman's Rank Correlations was conducted to examine type (positive or negative) and the strength (weak, moderate, strong etc.) of the relationships between the number of innovation and entrepreneurship courses (NIEC) taken by students, number of entrepreneurial role models (NERM) students have, and the nine variables that measure students' entrepreneurship competence and mindset (i.e., H2 and H3). Next, Cramer's V correlation test was performed to examine the associations between Gender and the nine indicators (OI, R, AI, A, EGM, PSA, CAT, BC, BN) of students' entrepreneurial skills, behaviours, and mindset (i.e., H4). This was followed by a Mann–Whitney U Test to examine whether there were statistically significant differences within the NERM grouping variable, the NIEC grouping variable, and the Gender variable (i.e., H4). Finally, a multiple linear regression was performed to examine the effect of students' number of entrepreneurial role models (NERM), number of innovation and entrepreneurship courses (NIEC), and Gender on generation creative ideas and spotting opportunities (IO).

Descriptive analysis

In this study, an online survey was administered to 332 students, and 331 completed surveys were returned, yielding a response rate of 99.7%. The online questionnaires received responses from 306 (92.4%) female students and 25 (7.6%) male students. The descriptive analysis results in Table 5 showed that out of the 306 participants, 108 (35.3%) of the students have work experience related to business and/or entrepreneurship. 37 (12.1%) students had (before) family business while 127 (41.5%) have (now) family business and 142 (46.4%) have no family business. Among the participants, 77 (25.2%) responded that they participated in the family business while studying, 40 (13.1%) stated that they do not remember, and 189 (61.8%) responded in the negative. When those with family business were asked in which industry is (now) or was (before) their family business operating, 29.3% mentioned the Food and Beverage Industry, 17.1% said the Clothing industry and 12.8% stated the Beauty and Cosmetic industry. However, 23.8% said their family businesses operate in "others" industry. Transportation industry, Education industry, and the Catering and Hospitality service industry have the lowest percentages registering 1.2%, 1.8%, and 1.8% respectively. Approximately, 152 (49.7%) students reported that they have one entrepreneurial role model (e.g., parent, family member, teacher, colleague, friend), 71 (23.2%) have two entrepreneurial role models, 32 (10.5%) have three entrepreneurial role models, only 1 (0.3%) student has four entrepreneurial role models, and 50 (16.3%) respondents have no entrepreneurial role model.

Table 5 Descriptive statistics

Business or entrepreneurial work experience	Count	Percentage (%)
Yes	108	35.3
No	198	64.7
Family business	Count	Percentage (%)
Yes (now)	127	41.5
No	142	46.4
Yes (before)	37	12.1
Participated in family business while studying	Count	Percentage (%)
Yes	77	25.2
No	189	61.8
I do not remember	40	13.1
Family business industry	Count	Percentage (%)
Food and Beverage Industry	48	29.3
Clothing Industry	28	17.1
Beauty and Cosmetics Industry	21	12.8
Catering and Hospitality Industry	3	1.8
Manufacturing & processing Industry	7	4.3
Agriculture and Veterinary Industry	7	4.3
Transportation Service Industry	2	1.2
Technology Industry	6	3.6
Education Industry	3	1.8
Others	39	23.8
Entrepreneurial role model (ERM)	Count	Percentage (%)
No Entrepreneurial role model	50	16.3
One entrepreneurial role model	152	49.7
Two entrepreneurial role models	71	23.2
Three entrepreneurial role models	32	10.5
Four entrepreneurial role models	1	0.3

Table 6 Normality test of the variables

Variables	Kolmogorov-Smirnov^a Shapiro-Wilk					
	Statistic	df	Sig	Statistic	df	Sig
Ideas and Opportunities (OI)	0.081	306	<0.001	0.964	306	<0.001
Resources (R)	0.130	306	<0.001	0.943	306	<0.001
Into Action (IA)	0.097	306	<0.001	0.960	306	<0.001
Adaptability (A)	0.086	306	<0.001	0.974	306	<0.001
Entrepreneurial Growth Mindset (EGM)	0.163	306	<0.001	0.903	306	<0.001
Problem Solving Attitude (PSA)	0.136	306	<0.001	0.939	306	<0.001
Critical and Analytical Thinking (CAT)	0.098	306	<0.001	0.953	306	<0.001
Business Collaboration (BC)	0.101	306	<0.001	0.958	306	<0.001
Business Networking (BN)	0.122	306	<0.001	0.966	306	<0.001

^a Lilliefors Significance Correction

Normality test

A normality test (Table 6) was performed to check and confirm if our data meet a normality assumption (which is required for parametric tests) or not. This will determine the appropriate metric (parametric or non-parametric) technique to use in the data analysis (Roni et al., 2020) to test the study's hypotheses and answer its research questions. According to the Kolmogorov and Shapiro statistical test results, all the nine variables: Ideas and Opportunities (OI), Resources (R), Into Action (IA), Adaptability (A), Entrepreneurial Growth Mindset (EGM), Problem Solving Attitude (PSA), Critical and Analytical Thinking (CAT), Business Collaboration (BC), and Business Networking (BN) had non-normal distributions (p -value < 0.05).

Spearman's rank correlations

All the nine variables that were employed in this study to measure entrepreneurial aptitudes, behaviors, and mindset had non-normal distributions (Table 7). Hence, Spearman's rank correlation (a non-parametric test) was used to examine the nature of association between two relationships: 1. The relationship between the number of innovation and entrepreneurship courses (NIEC) taken by students and the nine indicators of students' entrepreneurial education, skill, and mindset (i.e., H2), and 2. The relationship between the number of entrepreneurial role models (NERM) students have and the nine variables that measure students' entrepreneurship competence and mindset (i.e., H3) see Table 7. However, these relationships must not be interpreted as cause-and-effect associations.

The result of the analysis showed a statistically significant positive correlation between the number of entrepreneurial role models (NERM) variable and the nine variables except for PSA and BN variables (see Table 7). NERM had the greatest correlation with Resources (R) ($\rho = 0.194$, $P < 0.01$, $N = 306$, two-tailed), Business Collaboration (BC) ($\rho = 0.166$, $P < 0.01$, $N = 306$, two-tailed), and Ideas and Opportunities (IO) ($\rho = 0.155$, $P < 0.01$, $N = 306$, two-tailed) dimensions all at 0.01 significance level. Conversely, NERM had the weakest association with Into Action (IA) ($\rho = 0.125$, $P < 0.01$, $N = 306$, two-tailed) dimension. Although the correlation coefficients seem weak ($\rho = 0.194$ and $\rho = 0.155$) respectively, it is statistically significant and positive. It means the relationships between NERM and R as well as NERM and IO, for instance, are important to consider, and they move in the same directions.

Table 7 Spearman's Rank Correlations between two of the independent variables (NERM and NIEC) and dependent variables—measures of entrepreneurial competency and mindset (IO, R, IA, A, EGM, PSA, CAT, BC, and BN)

Variables	NERM	NIEC	IO	R	IA	A	EGM	PSA	CAT	BC	BN
NERM	1.000	–	0.155**	0.194**	0.118*	0.150**	0.150**	0.079	0.125*	0.166*	0.038
NIEC	–	1.000	0.234**	0.011	– 0.029	0.102	– 0.081	– 0.001	0.092	0.097	0.191**
N	306	306	306	306	306	306	306	306	306	306	306

**Correlations were significant at 0.01 level of significance (2-tailed)

*Correlations were significant at the 0.05 level (2-tailed)

Table 9 Man-Whitney U Test for NERM Differences with respect to the nine variables (IO, R, IA, A, EGM, PSA, CAT, BC, & BN)

Measures/Variables	IO	R	IA	A	EGM	PSA	CAT	BC	BN
Total N	306	306	306	306	306	306	306	306	306
Mann-Whitney U	5821.0	5052.5	5800.0	5523.5	5150.5	6125.0	5736.5	5900.5	5881.0
Mean Rank (Have ERM, N = 256)	155.76	158.76	155.84	156.92	158.38	154.57	156.09	155.45	151.47
Mean Rank (No ERM, N = 50)	141.92	126.55	141.50	135.97	128.51	148.00	140.23	143.51	163.88
Test Statistic (Z)	- 1.01	- 2.36	- 1.05	- 1.54	- 2.20	- 0.49	- 1.17	- 0.88	- 0.91
Asymp. Sig. (2-tail)	0.311	0.018	0.294	0.124	0.028	0.627	0.242	0.379	0.360

Mann-Whitney U test for NERM differences

A Mann-Whitney *U* Test was performed to examine if there was a significant difference between students who have entrepreneurial role models (Have ERM) and those who do not have (No ERM) in terms of generating creative ideas and spotting opportunities (IO), resources (R), into action (IA), adaptability (A), entrepreneurial growth mindset (EGM), problem-solving attitude (PSA), critical and analytical thinking (CAT), Business collaboration (BC), and Business Networking (BN) (Table 9). The mean ranks of the test results showed that students with entrepreneurial role models had higher entrepreneurial competency and mindset indicators than those without entrepreneurial role models on all the nine variables except for BN (Have ERM: Mean Rank = 151.47, $N = 256$; No ERM: Mean Rank = 163.88, $N = 50$; $U = 5881.0$, $Z = -0.91$, $p = 0.360 > 0.05$). However, the differences in the mean ranks for all the nine variables were not statistically significant except for R (Have ERM: Mean Rank = 158.76, $N = 256$; No ERM: Mean Rank = 126.55, $N = 50$; $U = 5052.5$, $Z = -2.36$, $p = 0.018 < 0.05$) and EGM (Have ERM: Mean Rank = 158.38, $N = 256$; No ERM: Mean Rank = 128.51, $N = 50$; $U = 5150.5$, $Z = -2.20$, $p = 0.028 < 0.05$) at 0.05 significance level.

Mann-Whitney U test for gender differences

A Mann Whitney *U* test was run to analyze if there was a significant difference between Gender (Boys and Girls) regarding the nine entrepreneurial skills and mindset indicators (i.e., H4). As shown in Table 10, mean ranks of the analysis suggest that female students had higher aptitude in terms of generating creative ideas and spotting opportunities (IO) (Girl: Mean Rank = 154.85, $N = 283$; Boy: Mean Rank = 136.89, $N = 23$; $U = 2872.5$, $Z = -0.937$, $p = 0.349 > 0.05$), resources (R) (Girl: Mean Rank = 154.46, $N = 283$; Boy: Mean Rank = 141.63, $N = 23$; $U = 2981.5$, $Z = -0.671$, $p = 0.502 > 0.05$), into action (IA) (Girl: Mean Rank = 155.29, $N = 283$; Boy: Mean Rank = 131.50, $N = 23$; $U = 2748.5$, $Z = -1.242$, $p = 0.214 > 0.05$), adaptability (A) (Girl: Mean Rank = 153.77, $N = 283$; Boy: Mean Rank = 150.13, $N = 23$; $U = 3177.0$, $Z = -0.191$, $p = 0.849 > 0.05$), and Business collaboration (BC) (Girl: Mean Rank = 155.64, $N = 283$; Boy: Mean Rank = 127.20, $N = 23$; $U = 2649.5$, $Z = -1.495$, $p = -1.495 > 0.05$). In contrast, male students recorded higher aptitude regarding entrepreneurial growth mindset (EGM) (Girl: Mean Rank = 153.21, $N = 283$; Boy: Mean Rank = 157.02, $N = 23$; $U = 3173.5$, $Z = -0.200$, $p = 0.841 > 0.05$), problem-solving attitude (PSA) (Girl: Mean Rank = 151.19, $N = 283$; Boy: Mean Rank = 181.89, $N = 23$; $U = 2601.5$, $Z = -1.616$, $p = 0.106 > 0.05$), critical and

Table 10 Man-Whitney U Test for Gender Differences with respect to the nine variables (IO, R, IA, A, EGM, PSA, CAT, BC, & BN)

Measures/Variables	IO	R	IA	A	EGM	PSA	CAT	BC	BN
Total N	306	306	306	306	306	306	306	306	306
Mann-Whitney <i>U</i>	2872.5	2981.5	2748.5	3177.0	3173.5	2601.5	2921.0	2649.5	3013.0
Mean Rank (Male, <i>N</i> =23)	136.89	141.63	131.50	150.13	157.02	181.89	168.00	127.20	164.00
Mean Rank (Female, <i>N</i> =283)	154.85	154.46	155.29	153.77	153.21	151.19	152.32	155.64	152.65
Test Statistic (<i>Z</i>)	-0.937	-0.671	-1.242	-0.191	-0.200	-1.616	-0.824	-1.495	-0.597
Asymp. Sig. (2-tail)	0.349	0.502	0.214	0.849	0.841	0.106	0.410	-1.495	0.551

analytical thinking (CAT) (Girl: Mean Rank = 152.32, *N* = 283; Boy: Mean Rank = 168.0, *N* = 23; *U* = 2921.0, *Z* = -0.824, *p* = 0.410 > 0.05) and business networking (BN) (Girl: Mean Rank = 152.65, *N* = 283; Boy: Mean Rank = 164.0, *N* = 23; *U* = 3013.0, *Z* = -0.597, *p* = 0.551 > 0.05). The results showed that while there were observable differences in aptitudes between genders across various skills, none of these disparities were statistically significant at the 0.05 significance level. This suggests that gender, within the scope of this study, does not play a significant role in determining students' entrepreneurial capabilities.

Regression analysis

Regression analysis explains how changes in an explanatory (predictor) variable, *x*, can account for variations in an outcome variable, *y*. Typically, regression is used to predict an outcome given one or more factors. While correlation enables us to analyze how two variables move concurrently, regression allows us to predict which predictor variables significantly affect the outcome and how strongly each predictor influences the outcome variable (Roni et al., 2020a). In this study, we hypothesize that the number of entrepreneurial role models (NERM) students have ($\times 1$), the number of innovation and entrepreneurship courses (NIEC) taken by students ($\times 2$), and Gender ($\times 3$) can influence the ability of students to generate entrepreneurial ideas (IO) and identify opportunities (\hat{y}). Using regression, the study can analyze to what extent the variability in (\hat{y}) is "shaped" by NERM ($\times 1$), NIEC ($\times 2$), and Gender ($\times 3$).

It is worth noting that evidence from the literature (e.g., Almeida, 2020; Elmassah et al., 2022; Li & Setiawan Sanusi, 2023); Joensuu-Salo, 2022; Karimi et al., 2014; Bikse & Riemere, 2013); Manishimwe et al., 2023) shows that the three predictor variables NERM ($\times 1$), NIEC ($\times 2$), and Gender ($\times 3$) influence entrepreneurial competencies and mindset. Thus, one may model (\hat{y}) as partially impacted by NERM ($\times 1$), NIEC ($\times 2$), and Gender ($\times 3$). In this scenario, the dependent or outcome variable, *y*, is IO while the influential elements ($\times 1$, $\times 2$, and $\times 3$) are the independent or predictor variables. The model from this scenario can be described as follows if it is to be written in a standard regression equation.

$$\hat{y} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

where y =outcome variable, students’ ability to generate entrepreneurial ideas (IO). α =intercept, y – value when all predictors are zero. β_1 =regression coefficient for NERM, $\times 1$. In its simplest form, this is the slope of the regression line for predictor, $\times 1$. β_2 =regression coefficient for NIEC, $\times 2$. This is the slope of the regression line for predictor, $\times 2$. β_3 =regression coefficient for Gender, $\times 3$. This is the slope of the regression line for predictor, $\times 3$. ϵ =error term. This is the error of approximation or prediction.

Model summary and ANOVA results analyses

The results of the regression analysis in Table 11 showed a coefficient correlation (R) of 0.322, which indicates that the relationship between the complete group of independent variables (NERM, NIEC, and Gender) and the dependent variable (IO) was moderately strong. Additionally, the test results of the analysis showed a coefficient of multiple determination (R^2) of 0.103. This indicates that the sum of all the predictor variables (NERM, NIEC, and Gender) explains 10.3% of the variance in IO—generating creative ideas and spotting opportunities. The study referred to the ANOVA test statistics result to determine the validity and significance of the overall regression model. The ANOVA test result indicates whether R^2 is greater than zero (0) or not. R^2 less than zero (0) shows that the regression model is valid, and a p -value of less than 0.05 indicates that the R^2 is significantly less than 0. The validity of our regression model is supported by the ANOVA results in Table 11: F statistic (3 302) = 11.621, p -value = 0.000 < 0.05, and R^2 = 0.103.

Reporting results

A multiple linear regression was performed on the data (N = 306) to examine the effect of students’ number of entrepreneurial role models (NERM), number of innovation and entrepreneurship courses (NIEC), and Gender on generation creative ideas and spotting opportunities (IO). The test results in Table 12 showed that our set of predictor variables NERM ($\beta_1 = 0.103, p = 0.028 < 0.05$), NIEC ($\beta_2 = 0.132, p = 0.000 < 0.05$), and Gender ($\beta_3 = 0.107, p = 0.481 > 0.05$), accounted for 10.3% of the variations in ideas and opportunities (IO), $R^2 = 0.103$, adjusted $R^2 = 0.095$, F statistic (3 302) = 11.621, p -value = 0.001 < 0.05. Hence, the remaining 89.7% of the variations in ideas and opportunities (IO) can be accounted for by other variables which are not included in the regression model. The estimated regression equation is:

$$\hat{y} = 3.420 + 0.103 \text{ NERM} + 0.132 \text{ NIEC} + 0.107 \text{ Gender}$$

Table 11 Results of Model Summary and ANOVA for the Regression model

Measure	R	R Square	Adj. R ²	df1	df2	F (Change)	Sig (F Ch)
Model Summary ^b	0.322 ^a	0.103	0.095	3	302	11.621	< 0.001
ANOVA ^c	....	.....	...	3	302	11.621	< 0.001 ^d

^a Predictors: (Constant), NERM, NIEC, Gender. ^bDependent Variable: IO. ^cDependent Variable: IO. ^dPredictors: (Constant), NERM, NIEC, Gender

Table 12 Outputs of Descriptive Statistics, Correlation, and Coefficients for the Regression model

Items	Measures/Variables	IO	NERM	NIEC	Gender
Descriptive Statistics	Mean	3.8928	1.28	1.70	0.92
	5% Trimmed Mean	3.9245	1.26	1.67	0.97
	Std. Deviation	0.7360	0.865	1.580	0.264
	Sample Size (N)	306	306	306	306
Correlations (Pearson)	IO	1.000	0.150	0.296	0.046
	NERM	0.150	1.000	0.101	0.022
	NIEC	0.296	0.101	1.000	0.018
	Gender	0.046	0.022	0.018	1.000
Sig. (1-tailed) *	IO	....	0.004	<0.001	0.211
	NERM	0.004	....	0.039	0.350
	NIEC	0.000	0.039	...	0.379
	Gender	0.211	0.350	0.379	...
Coefficients	Unstandardized Coefficients (B)	3.420**	0.103	0.132	0.107
	Sig	<0.001	0.028	<0.001	0.481
	Collinearity Stat. (Tolerance)	...	0.989	0.990	0.999
	Collinearity Statistics (VIF)***	...	1.011	1.011	1.001
	t-test	21.206	2.210	5.159	0.706

*Significance level is 1 tailed = $(0.05 \div 2 = 0.025)$, $p < 0.025$ for Correlations (Pearson)

**Equals α (constant) in the Multiple Linear Regression Equation

***VIF: Variance Inflation Factor. Our Dependent Variable is IO. Predictors are NERM, NIEC, and Gender

According to the interpretation of the results of the regression equation model, the coefficient (β_1) of NERM is (+0.103). This means that the ability of students to generate entrepreneurial ideas and identify opportunities (\hat{y}) is expected to increase by 0.103 unit for each additional number of entrepreneurial role model (NERM) when the other two predictor variables test are held constant. The p -value ($p = 0.028$) indicates that this variable (NERM) is significant. Similarly, the coefficient (β_2) of NIEC is (+0.132). It means IO increases by 0.132 units for each additional number of innovation and entrepreneurship courses holding the other two independent variables constant. Also, the p -value ($p = 0.000$) indicates that this variable (NIEC) is statistically significant. The coefficient (β_3) for Gender is (0.107). This means that IO is expected to rise by 0.107 units for female students compared to male when the NERM and NIEC variables test are held constant. However, the p -value for Gender ($p = 0.481$) suggests that the Gender variable is not significant. This means NERM and NIEC account for unique variance in IO as individual variables, while Gender does not.

Regarding the assumptions, the researchers utilized a standardized residuals scatter plot to test the residuals for linearity, normality, and homoscedasticity. The results met all the assumptions. By using a Q-Q plot and a simple scatter plot for each variable, the assumptions of normality and linearity of the variables were also met. It is important to point out that the box plot output of IO and NIEC suggests possible outliers in the dataset, which may be caused by monotone responses. However, for two reasons, we chose to include those cases in our analyses. 1. The difference between the mean and the 5% trimmed mean of IO (3.89 and 3.92, respectively) and NIEC (1.28 and 1.26, respectively) were not sufficiently large to permit the elimination of probable outliers in our dataset.

2. There was no asterisk (*) on the potential outliers, and the data points were rather close to the estimated value based.

Discussion

Several researchers have focused on the study of entrepreneurial education, competency, and mindset. Globally, research on educational entrepreneurship has rapidly expanded. The fact that entrepreneurship is now widely acknowledged as a key driver of economic growth and job creation (Uleanya, 2020) has helped to hasten this rapid increase.

This current study assessed the association and impact of the number of entrepreneurial courses taken by students, number of entrepreneurial role models that students have, and their gender on students' entrepreneurial education, aptitude, and mindset using nine entrepreneurial competency and mindset indicators (IO, R, IA, A, EGM, PSA, CAT, BC, & BN).

The result of the correlation analyses showed a statistically significant positive association between the number of entrepreneurial role models (NERM) variable and all the nine variables except for PSA and BN variables (see Table 8). This finding is consistent with other research that indicated a positive association between having an entrepreneur role model and a person's entrepreneurial skills and mindset. (Joensuu-Salo, 2022; Joensuu-Salo et al., 2015; Karimi et al., 2014). However, inconsistent findings were noted in a review by Zapkau et al. (2017). Next, the mean ranks result of the Mann–Whitney U test analyses revealed that students with entrepreneurial role models had higher entrepreneurial competency and mindset indicators than those without entrepreneurial role models on all the nine variables except for business networking (BN). However, the differences in the mean ranks for all the nine variables were not statistically significant except for resource (R) mobilization and entrepreneurial growth mindset (EGM).

Regarding the association between the number of innovation and entrepreneurship courses (NIEC) and the nine variables, the results showed a non-significant negative and positive correlations between NIEC and all the nine variables except for IO and BN—which were significant and positive. This could be explained by the finding of Pittaway and Edwards (2012) which suggests that most of the courses they reviewed do not adequately prepare the students for entrepreneurial endeavors. Instead, the courses educate people and help them understand entrepreneurship. In other words, the courses offer the 'About' approaches or the cognitive (such as knowledge, content, and conceptual ability), and not the 'Through' approaches or activity-based (such as starting a business, obtaining funding, and organizing) (Morris et al., 2013). Furthermore, Izquierdo and Buyens (2008) found that a constructivist action-oriented educational method has a favorable influence on undergraduate students' development of entrepreneurial competency.

As for the association between Gender and the nine indicators, the test analysis indicated a non-statistically significant positive correlation between all the associations. The results (e.g., the relationship's impact size of 0.343 between Gender and the IO indicator; see Table 8) implies that although the correlation was statistically insignificant, there exist a moderately strong positive association between gender and some aspects of entrepreneurial attitude and mindset. This corroborates with the view of Moreno-Gómez et al., (2020) that some studies have revealed based on the individual's approach

that there are differences between the fundamental psychological traits that men and women adopt, and that these traits are closely related to the entrepreneurial attitude and intention.

As for Gender differences in terms of the nine entrepreneurial skills and mindset indicators, the results suggested that female students had higher aptitude in terms of generating creative ideas and spotting opportunities (IO), resources (R), into action (IA), adaptability (A), and Business Collaboration (BC). In contrast, male students recorded higher aptitude regarding entrepreneurial growth mindset (EGM), problem-solving attitude (PSA), critical and analytical thinking (CAT), and business networking (BN). However, none of these differences in mean ranks were statistically significant. These findings do not support our hypothesis that overall, men have higher entrepreneurial competence and mindset than women (H4). Rather, women have greater entrepreneurial skills and attitude in some respects and vice versa. And this may depend on personality, environmental, legal, regulatory, economic, culture or social factors as highlighted by previous studies (Estrin & Mickiewicz, 2011; Goltz et al., 2015; Klyver et al., 2013; Moreno-Gómez et al., 2020).

Concerning the the effect of students' NERM, NIEC, and Gender on generation creative ideas and spotting opportunities (IO), results of the multiple linear regression analyses revealed that our set of predictor variables NERM, NIEC, and Gender accounted for 10.3% of the variations in formulating business ideas and identifying opportunities (IO). Hence, the remaining 89.7% of the variations in ideas and opportunities (IO) can be accounted for by other variables which are not included in the regression model. The p -values of NERM ($p = 0.028 < 0.05$) and NIEC ($p = 0.000 < 0.05$) indicate that both variables were statistically significant. These findings are in line with numerous empirical studies that have supported the general positive effect of role models on entrepreneurial intentions (Chlosta et al., 2012; Laspita et al., 2012; Liñán & Fayolle, 2015; Urbano et al., 2011). Likewise, regarding NIEC, findings by Izquierdo and Buyens (2008), Bikse and Riemere (2013), and Almeida (2020) confirmed that after a course or program intervention, students' self-assessments of their entrepreneurial self-efficacy were higher, and they have shown a greater capacity to offer new business concepts due to their better technical understanding in the sector. On the other hand, the p -value for Gender ($p = 0.481 > 0.05$) suggests that the Gender variable was not statistically significant. This means that NERM and NIEC account for unique variance in IO as individual variables, while Gender does not.

Conclusion

In summary, this study examined the relationships between entrepreneurial education, role models, gender, and students' entrepreneurial competency and mindset using nine indicators (IO, R, IA, A, EGM, PSA, CAT, BC, & BN). The findings highlight significant positive correlations between having entrepreneurial role models and various aspects of entrepreneurial competency and mindset, indicating the importance of mentorship and family business involvement in nurturing entrepreneurial attitudes.

Furthermore, the positive relationship between the number of innovation and entrepreneurship courses taken by students and their ability to generate business ideas and identify opportunities underscores the importance of comprehensive entrepreneurship

education. It emphasizes the need for curricula that integrate theoretical knowledge with practical skills, enabling students to take actionable steps towards entrepreneurship.

While gender differences were observed in certain aspects of entrepreneurial competency and mindset, they were not statistically significant. This suggests that gender may not be a significant determinant in shaping students' entrepreneurial abilities in the context of this study.

The implications of these findings extend to policymakers and educators, emphasizing the importance of fostering an entrepreneurial culture through mentorship programs, internships, and enriched entrepreneurship education. By prioritizing initiatives that facilitate interactions with established entrepreneurs and provide practical learning experiences, institutions can better prepare students for entrepreneurial activities.

However, it is essential to acknowledge the limitations of this study, including reliance on self-reported data and the study's single-institution focus, which may limit generalizability. Future research should consider longitudinal studies and qualitative methods to further explore the long-term effects of entrepreneurial role models and education on students' entrepreneurial journeys. Additionally, evaluating the effectiveness of specific programs aimed at promoting entrepreneurial competency among students can provide valuable insights for future interventions.

In conclusion, this study contributes to our understanding of the factors influencing students' entrepreneurial competency and mindset, providing valuable insights for policymakers, educators, and future research activities.

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Author contributions

KA conceived the research idea, designed methodology, developed questionnaire, and collected data, wrote and edited the manuscript, secured funding, and supervised the project. SS contributed to methodology, conducted data analysis and visualization, and participated in manuscript writing.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Application No: ERSC_2023_2472, titled "Assessing Entrepreneurial Competency and Mindset: Case of UAEU," by Khaula Alkaabi, has received approval from the UAEU Social Sciences Ethics Committee on 2023.

Competing interests

The authors report there are no competing interests to declare.

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