

# DEVELOPING AN ENTREPRENEURIAL THINKING AMONG ENGINEERING STUDENTS AT DONG NAI TECHNOLOGY UNIVERSITY

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## GENERAL INFORMATION

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## KEYWORDS

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*Experiential environment;*

*Entrepreneurial thinking factors.*

## ABSTRACT

This study addresses how engineering students perceive their entrepreneurial Thinking (ET) development during their University studies. Is the development of ET due to the incorporation of ET-based projects and activities into their curricula, or is it achieved through students' participation in extracurricular activities? Alternatively, ET development may be due to students cultivating ET through work or internship. Therefore, this study seeks to address the following research questions: "What types of experiences contribute to students' ET development? what ET elements do students perceive through these experiences?" The study included a qualitative analysis of interview data with engineering students to identify the experiences that contributed to their ET development, as well as the specific ET characteristics emphasized in these experiences. The study involved 24 undergraduate engineering students, this study employed semi-structured interviews and thematic analysis. The findings indicate that curriculum-based experiences were most frequently perceived by students as influential in developing entrepreneurial thinking, while off-campus internships also played a significant complementary role. By understanding students' perceptions of how they develop their ET, this study provides insights to identify best practices for future student ET development.

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## 1. INTRODUCTION

Although previous studies have demonstrated that entrepreneurial thinking skills can be developed through interventions, their

assessment is often based on scales and surveys. These surveys mainly reflect students' perceptions of their entrepreneurial thinking development to a certain extent, but often require

them to self-assess pre-determined skills by their lecturers. Furthermore, measurements are often taken immediately after the experiences have concluded, which may not accurately reflect the degree of connection between a specific experience and students' overall entrepreneurial thinking development. This approach somewhat limits the ability of students to fully express their perceptions of their own entrepreneurial thinking formation and development. This study addresses this gap by adopting a qualitative, interview-based approach to explore which specific learning experiences contribute to the development of ET and which ET elements emerge from those experiences, offering richer insights than survey-based assessments. By focusing on undergraduate engineering students at DNTU, the findings offer context-specific insights to inform curriculum design and experiential learning in engineering education.

The aim was to identify the types of experiences (in-curriculum, extracurricular, or off-campus) that students perceive as having the greatest impact on their entrepreneurial thinking development and to clarify the entrepreneurial thinking elements that are formed from those experiences. This study focuses on clarifying the entrepreneurial thinking development process of undergraduate engineering students through academic, extracurricular and practical activities.

## 2. THEORETICAL BASIS

In this study, entrepreneurial thinking (ET) refers to the cognitive, behavioral, and attitudinal capacities that enable individuals to recognize and act on value-creation opportunities, and is used interchangeably with the term entrepreneurial thinking.

### 2.1. Entrepreneurial thinking in curricula

In engineering training programs, many courses and projects are designed to simultaneously develop professional and business skills, including computer-aided design (CAD), 3D printing, marketing, patenting, and financial management (Brouwer et al., 2020). ET is often integrated into capstone projects at the end of the course. Students usually have one to two semesters to develop their designs, build prototypes, and combine them with business plans. Surveys of students participating in these projects show that they recorded significant improvements in leadership, teamwork, and problem-solving skills, while their ability to plan businesses and manage finances remains limited (Ali et al., 2020).

### 2.2. Entrepreneurial thinking in extracurricular activities

Students with high confidence in their professional and communication skills are more likely to actively participate in extracurricular activities (Sheppard et al., 2010), which have been shown to positively impact the development of entrepreneurial skills. Through these activities, students have the opportunity to expand their knowledge and consolidate the skills developed during their studies (Chachra et al., 2009). Common types of extracurricular activities include scientific research, engineering clubs, community service learning, and international exchange programs, which have been shown to increase motivation, problem-solving ability, communication, networking, and creativity.

Furthermore, the establishment of entrepreneurial centers and student clubs plays a crucial role in cultivating entrepreneurial

thinking among engineering students. These centers serve as a bridge between theoretical knowledge and real-world experience by providing a practice-oriented environment (Ndou et al., 2018). Participation in such communities has been found to significantly boost students' entrepreneurial interests and capabilities (Jackson et al., n.d.).

### 2.3. Entrepreneurial thinking through internships outside the University

Although entrepreneurial thinking is often studied in an academic context, internships and professional experiences outside school have also been shown to positively impact the formation and development of entrepreneurial thinking. Students who participate in work or internships during their University studies often develop intrinsic motivation, curiosity, the ability to recognize opportunities, leadership skills, and professional competence (Chen et al., 2017). Several studies have shown that off-campus work experience enhances business skills and community awareness and helps students gain the necessary competencies and certifications, thereby creating an advantage in their future careers.

## 3. METHODS

This study employed a qualitative research design to explore students' perceptions and experiences related to entrepreneurial thinking development. It was conducted to answer the following two main research questions:

- What types of experiences contribute to the development of ET in engineering students?
- What ET factors do engineering students perceive as being formed through these experiences?

To address these questions, the research

team collected and analyzed data according to the following steps:

### 3.1. Research design

A purposive sampling strategy was employed to recruit undergraduate engineering students who had participated in curricular, extracurricular, or off-campus activities related to entrepreneurial learning. This study comprised a sample of 24 undergraduate students from engineering disciplines. This sample size was deemed sufficient based on the principle of data saturation, as no new themes emerged following the 20th interview. Notably, the majority of participants possessed prior experience in small-scale entrepreneurial activities during their University studies. The sample distribution by academic year included 12 fourth-year, 5 third-year, 4 second-year, and 3 first-year students. Six different engineering majors at Dong Nai University of Technology were represented in the research sample, ensuring diversity in the majors and training contexts. Specifically, there were 6 students majoring in Automotive Engineering Technology, 3 students in Electrical Engineering, 4 students in Electronic Engineering, 2 students in Civil Engineering, 5 students in Mechanical Engineering and 4 students in Information Technology.

### 3.2. Data Collection

Students were invited to participate in semi-structured interviews revolving around the concept of ET. Semi-structured interviews were conducted either face-to-face or online, depending on participants' availability. The interview protocol consisted of approximately 6–8 open-ended questions focusing on students' learning experiences, entrepreneurial-related activities, and perceived impacts on ET. Sample interview prompts included questions such as "Which learning experiences during your University studies most influenced your

entrepreneurial thinking?” and “How did activities inside or outside the University help you develop entrepreneurial-related skills?”.

Students were asked to define ET based on their personal understanding and list related factors. Students were provided with a standard definition of ET based on a synthesis of documents, and then asked questions to explore the comparison between personal perceptions and the reference definition. Students were encouraged to reflect on their real-life experiences (in and out of school) that they believe contributed to the development of ET. The interviews lasted 40-60 minutes and were conducted online (MS Teams) and in person.

Ethical considerations were observed throughout the study. Participation was voluntary, and informed consent was obtained from all participants prior to the interviews. Participants were assured of confidentiality and anonymity, and all data were used solely for research purposes.

### 3.3. Data Analysis

The qualitative data collected from semi-structured interviews were transcribed and analyzed using thematic analysis. The analysis followed three main steps:

The analysis was conducted in three main stages. First, during the initial coding phase, meaningful units related to students' perceptions of ET were identified. Next, in the categorization

stage, similar codes were grouped into broader conceptual categories based on recurring patterns. Finally, in the theme development stage, these categories were synthesized into overarching themes that represent the types of experiences contributing to ET, as well as the ET elements perceived by students.

Thematic analysis was conducted following an iterative coding process. Two researchers independently coded a subset of the transcripts, and discrepancies were discussed until consensus was reached, thereby enhancing analytical reliability.

This analytical process ensured that findings emerged inductively from students' narratives rather than from predetermined quantitative structures.

For the first research question, the thematic analysis was based on Brush's University entrepreneurial environment model (Brush, 2014) and expanded to include off-campus experiences such as internships, jobs, important events, or high school activities. The entrepreneurship education ecosystem model by Brush (2014) was used to guide coding because it captures how curricular and experiential contexts shape entrepreneurial development, and was adapted to map students' experiences in engineering education (Brush, 2014; Ndou et al., 2018). Table (1-3) presents the groups of surveyed experiential factors.

**Table 1.** Undergraduate Program Experiences contributing to ET Development

Key Factors	Definition
Curriculum	A course where engineering students feel supported in their ET development
	Projects are graded and delivered as part of a University course that has influenced the development of ET.

Key Factors	Definition
Extracurricular Activities	Technical Clubs: Engineering-related clubs/extracurricular activities that the student believes may help influence the development of ET. This may include any seminars/presentations attended as part of participation in these activities.
	Non-engineering-related clubs/extracurricular activities that the student believes may help influence the development of ET. This may include any seminars/presentations attended as part of participation in these activities.
Entrepreneurial Research	Research projects that have business partnerships, commercialisation components or involve entrepreneurship that the student has participated in or witnessed that have influenced their ET.

**Table 2.** Students' experience of the University environment measured through a scale that contributes to the development of ET

Key Factors	Definition
ET Infrastructure	Centres and/or departments within the University that have helped support the development of students' entrepreneurship
Stakeholders	Faculty, staff and other students involved in the curriculum, extracurricular or research have contributed to the development of students' entrepreneurship
Culture	The general environment, atmosphere and lifestyle of the University have led to the development of students' entrepreneurship factors
Relationships	Resources used by students such as partnerships, technology, business incubators, etc. leading to the development of ET

**Table 3.** Experiences Through the University's Outside Internship Activities Contributing to the Development of ET

Key Factors	Definition
Technical Jobs and Internships	Placements outside of college related to engineering such as jobs or internships that helped students develop ET
Non-Technical Jobs and Internships	Paid positions or non-engineering related outside/volunteer activities that students believe influenced their ET development

<b>Key Factors</b>	<b>Definition</b>
High School Experience	Experiences as part of the secondary school curriculum and extracurricular activities that contributed to students' ET development
Key Events	Transformative events outside of engineering such as significant life changes, activities or defining moments that led to the development of ET

For the second research question, the analysis focused on identifying the elements that constitute ET from the perspectives of students and reference materials. These elements were standardized into the framework shown in Table 4.

**Table 4.** ET Elements (Sheppard et al., 2010)

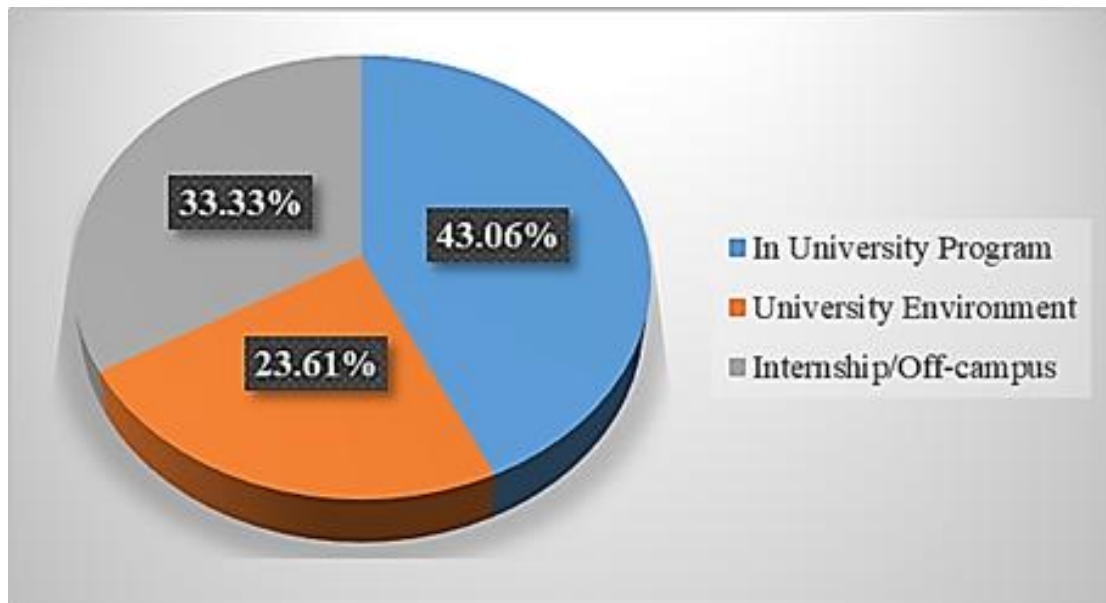
<b>ET Factors</b>	<b>Definition</b>
Business Skills	The set of skills an entrepreneur possesses in the field of business, such as efficiency, budgeting and spending, decision making, marketing, resource management, and knowledge of production processes.
Personality Traits	The qualities a person possesses, such as motivation, charisma, curiosity, empathy, and self-awareness.
Communication	The ability to work well in a team, connect with others, be open to the process, bridge the gap between business and technical knowledge, and always focus on the customer.
Creativity	The ability to think creatively, generate original ideas, and turn imagination and ideas into reality.
Innovation	The ability to see the big picture and improve existing products and processes to improve society and move toward a more efficient future.
Problem Solving	The act of encountering an obstacle that needs to be overcome and using previous knowledge and some skills to find a solution or improve something.
Responsibility	Ability to demonstrate leadership and manage money and time effectively.
Technical Knowledge	Knowledge gained through laboratory work and research in engineering helps develop more beneficial products for society.

## 4. RESULTS AND DISCUSSION

This section details the findings derived from the qualitative analysis of interviews with 24 engineering students. As participants reported multiple experiences, the aggregate number of recorded experiences exceeds the sample size. Through thematic analysis, the study identifies the diverse experiences contributing to the development of entrepreneurial thinking (ET), as well as the specific ET characteristics cultivated through these interactions.

### 4.1. Interview findings for RQ1

Question 1 focused on exploring the types of events and experiences that students associated with the development of their ET. A total of 72 experiences were recorded (An average of three experiences per participant). Figure 1 shows the percentages calculated based on the total number of reported experiences ( $n = 72$ ).



**Figure 1.** Distribution of experiences by environment

- In the undergraduate program, 18/24 students mentioned experiences from engineering projects or courses, especially in the first and second years. These subjects often integrate design projects, teamwork, and business model simulations. With 31 recorded experiences, this group had the highest proportion, surpassing research or extracurricular activities.

- Experiences related to the broader university environment were reported less frequently than curriculum-based activities. Of

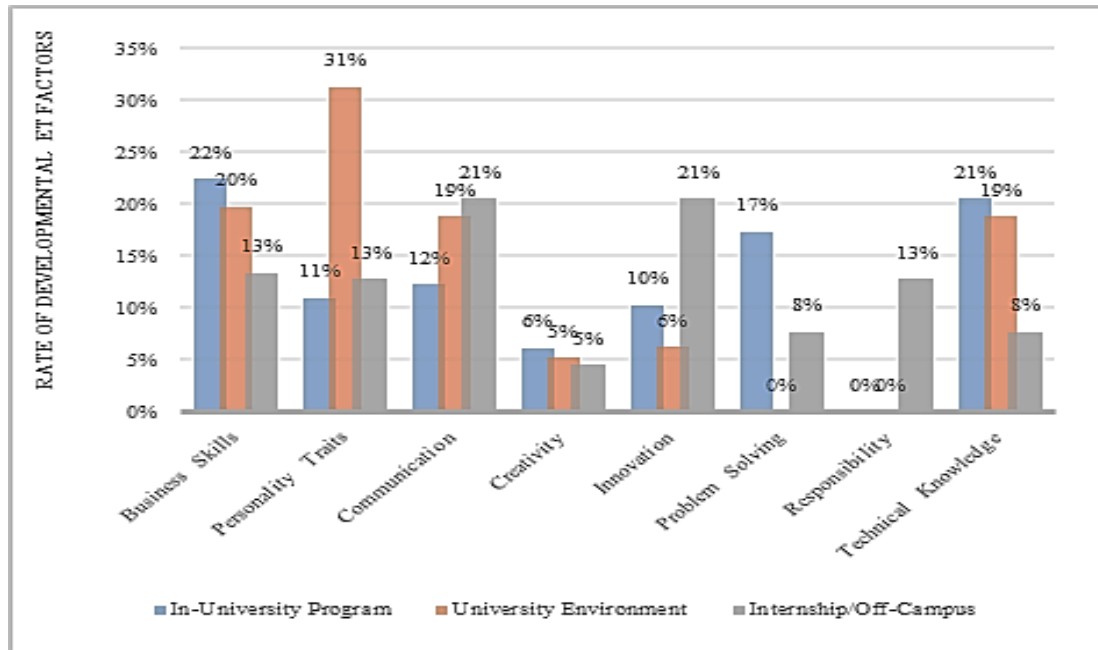
these, the factor “stakeholders” (lecturers, classmates) was reported eight times, reflecting the role of support and encouragement in forming the concept of ET.

- Off-campus and internship experiences were commonly reported by students, especially part-time work or internships not directly related to engineering, such as service roles, small businesses, and customer care. These experiences contribute to the development of communication skills, customer management, and self-confidence.

The results show that the majority of students link the development of ET to academic experiences in the main program, but at the same time, many also recognize the complementary role of internships and off-campus activities.

## 4.2. Interview findings for RQ2

Question 2 aimed to identify the elements of ET that students believed were reinforced by their experiences. In total, 55 experiences were analyzed.



**Figure 2.** Percentage of ET elements developed by the environment.

In the University program, the two most prominent elements developed were business skills and technical knowledge. This is consistent with the characteristics of the program, which integrates technical projects and startup models. Some students also emphasized the role of extracurricular activities in problem-solving training.

- University environment: The most prominent is the development of personality traits (motivation and perseverance), mainly through the influence of lecturers and classmates.

- Internship/outside the school: The prominent skills formed were communication and innovation (appearing in half of the internship and work experiences). In addition,

some students mentioned the enhancement of their responsibility.

## 4.3. Discussion

The synthesis of findings from the two research questions indicates that ET is shaped through multiple, interconnected learning contexts. Curriculum-based experiences emerged as the most influential source, and were perceived by students as having the strongest impact. Through structured instruction, scaffolded assessments, and project-based learning such as CAD laboratories, capstone projects, and market analysis exercises, the formal curriculum supports the systematic development of both technical expertise and business competencies. This finding is consistent

with Brouwer et al. (2020), who demonstrated that integrating entrepreneurial elements into engineering coursework effectively enhances students' business acumen alongside technical proficiency.

Although extracurricular activities and research experiences were mentioned less frequently, they contributed meaningfully to the development of problem-solving and critical thinking skills, which are widely recognized as core components of ET. In addition, the broader University environment played an indirect yet important role, particularly through interactions with lecturers and peers. The supportive influence of teaching staff on students' motivation and entrepreneurial attitudes aligns with the entrepreneurship education ecosystem perspective proposed by Ndou et al. (2018), which emphasizes the role of institutional culture and stakeholder engagement in fostering entrepreneurial capacities.

Furthermore, off-campus experiences especially, non-engineering part-time jobs, and small-scale business activities were perceived as particularly effective in developing communication, innovation, and responsibility. These findings extend the work of Chen et al. (2017) by showing that real-world work contexts expose students to authentic interpersonal interactions and performance-related consequences, thereby strengthening behavioral and interpersonal dimensions of ET. Overall, the results suggest that while the formal curriculum provides a foundational role in developing entrepreneurial knowledge and business skills, extracurricular and off-campus experiences play a complementary role by enhancing practical and social competencies essential for entrepreneurial development.

## 5. CONCLUSION

The study found that multiple types of experiences influence the formation and development of ET in engineering students. Among them, University experiences play the most important role, especially in-class learning, co-teaching, and research activities. These experiences not only help students consolidate their professional knowledge, but also develop problem-solving skills, teamwork, and the ability to apply knowledge to professional practice. In addition, off-campus experiences, especially internships and part-time jobs, contribute significantly to ET development. Although many jobs are not directly related to engineering, they help students practice communication skills, creative thinking, and confidence when collaborating with experts from many different fields.

These results affirm that creating diverse experiential opportunities for students is a key factor in developing ET. The combination of experiences in school and society forms a comprehensive skill set, contributing to the development of flexible and creative business thinking. Therefore, educational institutions should focus on designing training programs that integrate different forms of experience, thereby preparing students with a solid foundation to achieve success in their future careers.

This study advances a qualitative, experiential perspective on ET development in engineering education, showing how curricular and experiential contexts jointly shape entrepreneurial capacities. The findings highlight the need to integrate project-based learning, experiential opportunities, and University–industry collaboration within engineering programs. However, the study is limited by its small, single-institution sample and reliance on

self-reported data, suggesting that future research should employ multi-institutional and mixed-methods or longitudinal approaches.

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# PHÁT TRIỂN TƯ DUY KHỞI NGHIỆP TRONG SINH VIÊN KỸ THUẬT TẠI TRƯỜNG ĐẠI HỌC CÔNG NGHỆ ĐỒNG NAI

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## THÔNG TIN CHUNG

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Ngày duyệt đăng: 20/03/2026

## TỪ KHOÁ

*Tư duy khởi nghiệp;*

*Sinh viên kỹ thuật;*

*Phát triển tư duy khởi nghiệp;*

*Môi trường trải nghiệm;*

*Các yếu tố tư duy khởi nghiệp.*

## TÓM TẮT

Nghiên cứu này đề cập đến cách sinh viên kỹ thuật nhận thức về sự phát triển Tư duy Khởi nghiệp (ET) của họ trong suốt quá trình học đại học. Liệu sự phát triển ET có phải do việc tích hợp các dự án và hoạt động dựa trên ET vào chương trình học, hay là do sinh viên tham gia các hoạt động ngoại khóa? Hoặc, sự phát triển ET có thể là do sinh viên trau dồi ET thông qua công việc hoặc các hoạt động khác. Do đó, nghiên cứu này tìm cách giải đáp các câu hỏi nghiên cứu sau: “Những loại trải nghiệm nào góp phần vào sự phát triển ET của sinh viên? Sinh viên nhận thức được những yếu tố ET nào thông qua những trải nghiệm này?” Nghiên cứu bao gồm phân tích định tính dữ liệu phỏng vấn với sinh viên kỹ thuật để xác định những trải nghiệm góp phần vào sự phát triển ET của họ, cũng như các đặc điểm ET cụ thể được nhấn mạnh trong những trải nghiệm này. Với sự tham gia của 24 sinh viên kỹ thuật bậc đại học, nghiên cứu này đã sử dụng phỏng vấn bán cấu trúc và phân tích chủ đề. Kết quả cho thấy, các trải nghiệm dựa trên chương trình học được sinh viên thường xuyên nhận thấy là có ảnh hưởng nhất đến sự phát triển tư duy khởi nghiệp, trong khi các kỳ thực tập ngoài trường cũng đóng vai trò bổ sung quan trọng. Bằng cách hiểu được nhận thức của sinh viên về cách họ phát triển ET, nghiên cứu này cung cấp thông tin cần thiết để xác định các phương pháp tốt nhất cho việc phát triển ET của sinh viên trong tương lai.