Journal of Engineering Education Transformations,
Volume No. 37, January 2024 Special Issue, eISSN 2394-1707

Cultivating a Culture of Innovation Nurturing Entrepreneurial Spirit and Startup Mindset in Engineering Education

Gurunadham Goli[1] and D Ramesh Babu[2]

[1,2]School of Business, SR University, Warangal, Telangana, India – 506371.
[1]mbagurunath@gmail.com
[2]rameshdamarla2009@gmail.com

Abstract **-- In today's rapidly evolving world, the role of engineers has transcended conventional boundaries, requiring not just technical proficiency, but also the ability to think creatively, adapt swiftly, and translate concepts into practical solutions. This article underscores the significance of instilling a culture of innovation, entrepreneurial spirit, and startup mindset within engineering education. It emphasizes the need for these qualities in light of the dynamic nature of engineering challenges. The evolving educational landscape must instill students with the capacity to tackle future complexities. This article accentuates the essence of entrepreneurial thinking and startup-oriented approaches without resorting to quantitative or qualitative analysis. It explores how integrating entrepreneurial concepts into engineering education can foster inventiveness, interdisciplinary cooperation, and industry preparedness. Furthermore, it addresses the potential hurdles in implementing such an approach. In essence, this article asserts that by cultivating entrepreneurship, educators equip engineering students to emerge as inventive problem solvers and catalysts for societal advancement.**

Keywords**---Engineering; Education; Entrepreneurial; Industrial; Innovation**; **Start up.**

I. INTRODUCTION

Amidst the swift advancement of technology and the interconnectedness of the global landscape, engineers find themselves surpassing conventional boundaries. As the realm of design solutions grows increasingly intricate and diverse, there arises a burgeoning demand for engineers who, beyond their technical acumen, possess entrepreneurial prowess and a mindset geared toward startups.

This paper was submitted for review on Aug 20, 2023. It was accepted on Nov, 15, 2023.
Corresponding author: Gurunadham Goli, School of Business, SR University, Telangana, India.
Address: SR University, Warangal, Telangana, India – 506371
(e-mail: mbagurunath@gmail.com).

This article delves into the strategies to nurture these Attributes within engineering education, equipping students with the means to propel innovation and drive revolutionary shifts. Adapting engineering education to align with these evolving requisites stands as an issue of Paramount significance. UNESCO's research underscores the urgency of educational systems fostering creativity, critical thinking, and problem-solving aptitude alongside technical expertise, addressing the intricate challenges of the 21st century (UNESCO, 2015). Correspondingly, the National Academy of Engineering (NAE) underscores the necessity for engineering education to foster interdisciplinary collaboration, effective communication, and a holistic approach to problem-solving (NAE, 2004). The convergence of business and engineering education has emerged as a focal point in recent times. The infusion of entrepreneurial concepts into engineering curricula has proven to bea catalyst for students' innovation and resourcefulness (Fayolle & Gailly, 2008). Moreover, enhancing entrepreneurial skills enhances graduates' employability, as modern companies seek individuals who can not only devise technical solutions but also drive business development and innovation (Kuratko, 2005).

This article directs its focus toward the broader implications of cultivating an entrepreneurial spirit and a startup mindset within engineering. The primary aim here is to underscore the overarching significance of these concepts within the sphere of engineering education. By delving into the evolving technological landscape, encapsulating the core tenets of entrepreneurship, outlining the principles intrinsic to a startup mindset, and elucidating the challenges and prospects entailed in their integration within education.

II. LITERATURE REVIEW

The literature review section intricately weaves together distinctive thematic categories to offer a unified perspective on fundamental concepts, theoretical frameworks, and empirical studies pivotal to nurturing an entrepreneurial mindset

among engineering students. The Nexus of Entrepreneurship and Engineering Education: The evolution of engineering education now encompasses the integration of entrepreneurship as an indispensable skillset. Drucker (1985) contends that entrepreneurship propels both economic growth and innovation. Concurrently, Sarasvathy's (2001) elucidation of entrepreneurial thinking through effectual reasoning underscores the fluid nature of entrepreneurship. The fusion of entrepreneurship with engineering education emerges as a catalyst, emphasizing the paramount significance of cultivating an entrepreneurial mindset in future engineers. The Interplay of Innovation and Design Thinking: Design thinking, renowned for its focus on problem-solving and innovation driven by user needs, resonates powerfully within entrepreneurship education. Brown and Wyatt (2010) ardently advocate for design thinking as an enabler to instill innovative and entrepreneurial perspectives. This harmony between innovation and entrepreneurship augments the call to infuse entrepreneurial thinking seamlessly into the fabric of engineering curricula. Experiential Learning and Real-world Application: Experiential learning, acting as a bridge between theoretical constructs and practical application, stands as a hallmark of potent entrepreneurship education. Leshner and Laskowska (2017) delve into the augmentation of engineering education through experiential learning, immersing students in real- world projects. This approach germinates problem- solving skills and nurtures a culture of applying entrepreneurial principles in tangible scenarios. Collaborative Platforms and Interdisciplinary Ventures: Collaboration, inherent to entrepreneurship, thrives through interdisciplinary engagements. Neck and Greene (2011) underscore the imperative of interdisciplinary collaboration within entrepreneurship education. Echoing this sentiment, the "T-shaped" skills framework articulated by Brown and Wyatt (2010) envisions engineering graduates as possessing technical depth coupled with the ability to collaborate across diverse domains. Ecosystems and Educational Environments: The paradigm of startup ecosystems provides insights into crafting nurturing environments for entrepreneurship. Feld (2012) meticulously dissects the components that constitute thriving startup communities. In alignment, Isenberg (2010), advocates for an educational revolution achieved by aligning educational systems with the dynamic underpinnings of these ecosystems. Digital Entrepreneurship and Technological Innovation: In the era of digital transformation, technology reshapes entrepreneurship. Nambisan (2017) navigates the terrain of digital entrepreneurship, underscoring technology's pivotal role in fostering innovation and propelling entrepreneurial ventures.

Active learning methodologies and problem-based approaches are promising in promoting entrepreneurial thinking. Kolb's (1984) experiential learning and its variations emphasize learning through concrete experiences, reflective observation, abstract conceptualization, and active experimentation. Embedding these pedagogical approaches into engineering curricula can promote critical thinking and the development of an entrepreneurial mindset. Development of entrepreneurial skills and abilities: Identifying and developing entrepreneurial knowledge and skills are central to engineering education. Fiet's (2000) research identifies key skills needed by entrepreneurs such as opportunity recognition and risk management. Integrating competency-based education can provide engineering students with the practical skills needed for entrepreneurship. Change your mindset and attitude: Dweck's (2006) popularized mindset theory distinguishes between fixed and growth mindsets. Engineering educators can use this theory to encourage a growth mindset and foster a belief in the malleability of skills and abilities. Developing a growth mindset can positively influence engineering students' attitudes toward innovation, challenge, and failure as stepping stones to success. Global and cultural aspects of business: Engineering education is becoming increasingly global and exposure to different cultural contexts can shape entrepreneurial thinking. The study of Matlay (2008) examines cultural influences on entrepreneurship education. Understanding how different cultures view and practice entrepreneurship can enrich engineering curricula with a global perspective. Social entrepreneurship and sustainable development: The concept of social entrepreneurship is intertwined with innovation and social impact. Mair and Marti (2006) see the power of change in social entrepreneurship. Integrating social entrepreneurship and sustainability into engineering education can broaden students' horizons and increase their responsibility in solving real-world challenges. Innovation Ecosystems and Incubators: The exploration of innovation ecosystems and business incubators within engineering education yields valuable insights for nurturing entrepreneurial thinking. Isenberg's seminal work (2010) elucidates the creation of dynamic entrepreneurial ecosystems, underscoring the pivotal role of incubators and accelerators in fostering the growth of startups. Design Entrepreneurship and User-Centered Innovation: The fusion of design thinking with

entrepreneurship accentuates the significance of user- centric innovation. Brown and Katz's comprehensive study (2011) delves into the symbiotic relationship between design thinking and the cultivation of entrepreneurship and innovation. Play and Experiential Learning: Harnessing the potential of gaming and immersive experiences enhances the landscape of entrepreneurship education. Mora and Kettinger's contemporary research (2018) explores the infusion of play within educational contexts, unveiling its capacity to amplify engagement and enrich learning outcomes. Technology Entrepreneurship and Startups: The exploration of the nexus between technological innovation and entrepreneurship offers profound insights within the realm of engineering. Audretsch et al.'s comprehensive examination (2018) scrutinizes technology's role as a catalyst for entrepreneurship and economic advancement. Online Learning Platforms and Virtual Entrepreneurship: The ascendancy of online learning platforms and virtual domains presents novel vistas for entrepreneurship education. Bigham et al.'s contemporary discourse (2020) delves into the realm of virtual entrepreneurship education, shedding light on its potential to shape students' entrepreneurial aspirations.

Technopreneurship education with focuses on innovation, team working skills and creativity can have positive impact on students to develop their techno entrepreneurship skills Zaki, Y., Al Muwali, A., & Mahdi, N. (2021).

In summary, the literature review highlights essential tactics to foster an entrepreneurial mindset within engineering education. Active learning, problem-based techniques, and competence building are pivotal. Shifting perspectives using growth mindset theories and embracing global diversity are significant factors. Augmenting education through innovation ecosystems, design entrepreneurship, and experiential learning is impactful. Technological entrepreneurship and virtual platforms present contemporary avenues. Collectively, these strategies empower engineering students to navigate a dynamic, innovative landscape with an entrepreneurial zeal.

III. OBJECTIVES

- To explore the incorporation of entrepreneurship concepts into engineering education.
- To assess the benefits of fostering a startup mindset in engineering students.
- To identify challenges and opportunities related to fostering innovation in the curriculum.
- To provide recommendations for effective promotion of entrepreneurship in engineering programs.

IV. RESEARCH METHODOLOGY

This study uses qualitative research, with the main focus on a comprehensive literature review that aims to identify the importance of integrating innovation, entrepreneurship and entrepreneurial thinking into engineering education. The methodology includes a comprehensive review of scientific sources to understand the involvement of entrepreneurship inengineering, the formulation of a theoretical framework that explains the relationship between entrepreneurship and technology using synthesized literature, and a review of literature findings to reveal visible themes. This methodology aims to provide in-depth insights into the adoption of entrepreneurship in engineering education using solidacademic knowledge

V. DISCUSSION

A. The Incorporation Of Entrepreneurship Concepts Into Engineering Education

The infusion of entrepreneurial concepts into engineering education involves a forward-looking strategy that prepares students for the changing demands of the modern era. These approaches not only equips engineering students with technical expertise but also with entrepreneurial skills that enable them to discover opportunities, innovates and skillfully navigate the complexities of the business world. A way to integrate entrepreneurship concepts is to include entrepreneurship modules in the engineering curriculum. These modules cover different areas such as market analysis, business planning, intellectual property management, financial strategies and project implementation. By making this interdisciplinary presentation, students gain a holistic understanding of how their technical innovations fit market needs and commercial viability (Fayolle and Gailly, 2008). In addition, experiential learning plays a key role. By participating in practical business, universities form a bridge between theoretical knowledge and real applications. Platforms such as business projects, hackathons and startup competitions allow students to participate in idea generation, prototyping and even present innovations to potential investors or customers. This practical encounter increases the ability to solve problems, promotes the spirit of cooperation and encourages initiative and risk (Lackéus, 2015). Another effective way is to include business-oriented modules in the engineering curriculum. These modules cover a range of topics

including market analysis, business planning, intellectual property management, financial strategiesand project implementation. By combining these aspects, students gain a holistic understanding of howtheir technical ingenuity aligns with market needs and business viability (Henneberg et al., 2016). Experiential learning reinforces this integration. Through hands-on projects such as entrepreneurial projects, hackathons and startup competitions, students immerse themselves in real-world problem solving, prototyping and even pitching to potential investors or clients. This tangible experience fosters collaboration, catalyzes innovative thinking, and fosters both initiative and the tendency to take calculated risks (Fayolle and Gailly, 2008).By weaving entrepreneurial concepts into engineering education, educational institutions give students the opportunity to familiarize themselves with their technical skills in a broader business environment. This approach not only increases their innovative potential, but also develops the skills needed to turn ideas into practical solutions that effectively respond to real challenges.

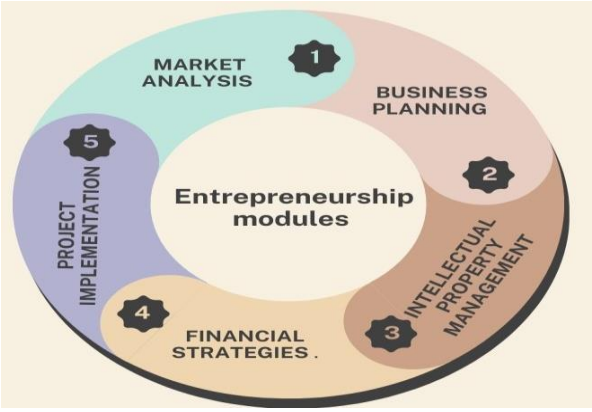

Fig1: Entrepreneurship Course and Its Modules

B. The Benefits of Fostering A Startup Mindset in Engineering Students:

Fostering a startup mindset among engineering students offers many benefits that go beyond technical skills. This approach provides students with the versatile skills and diverse perspectives critical to success in the rapidly evolving landscape of modern industry. Adaptability and flexibility are important qualities; a startup mindset increases readiness to embrace change and skillfully navigate uncertainty. Students learn to face challenges, iterate solutions and pivot when necessary, which improves their resilience (Lackéus, 2015). Innovation and creativity are also nurtured; the startup mentality stimulates innovative thinking and encourages students to design new solutions and cross traditional boundaries, which contributes to the creation of new products and services (Rasmussen et al., 2018). Entrepreneurial thinking takes root; Students acquire the basic principles of business operations that enablethem to spot market opportunities, assess risks and create value. This holistic perspective is central to today's multidisciplinary environment (Kuratko, 2005). Group work also gains visibility; the spirit of collaboration inherent in start-ups encourages in students effective teamwork, which promotes the appropriate use of multifaceted competences and multidisciplinary (Rasmussen et al., 2018). In addition, the ability to solve problems will gain momentum; A startup mindset encourages students to approach problems from multiple perspectives, seek unconventional solutions, and improve analytical skills (Fayolle and Gailly, 2008). Thus, fostering a startup mindset equips engineering students with qualifications essential for overall development and professional success.

Table 1: Benefits of Fostering a Startup Mindset

S. No	Skills	Adaptability
1	Willingness to take risks and initiative	Students develop a willingness to take caculated risks and initiate projects. This increases a proactive attitude and the ability to seize opportunities (Henneberg et al., 2016).
2	Leadership skills	The entrepreneurial environment fosters leadership qualities, as students often have to take care of projects, motivate teams and direct initiatives (Rasmussen et al., 2018).
3	Market Relevance	Understanding market trends and customer needs becomes an integral part of the startup mindset, ensuring graduates meet real-world demands (Kuratko, 2005).
4	Career flexibility	Even if students do not engage in entrepreneurship, the skills acquired from entrepreneurial thinking make them adaptable to different career paths and industries (Lackéus, 2015).

By introducing a startup mindset, engineering education improves students' ability to adapt, innovate, manage and effectively participate in the changing demands of the professional world.

C. Challenges And OpportunitiesRelated To Fostering Innovation In The Curriculum:

1) Challenges:

Resistance to change: Traditional educational models can resist the integration of innovative approaches because they require a reassessment of

the curriculum and teaching methods (Lackéus, 2015). Lack of faculty training: Educators may lack training in instructional innovations or may have difficulty adapting to new methods (Heneberg et al., 2016). Assessment metrics: Measuring innovative thinking can be difficult because it often outperforms traditional assessment methods based on standardized tests (Fayolle and Gailly, 2008). Resource limitations: the introduction of new methods may require additional resources, both in terms of money and time (Rasmussen et al., 2018). Assessment authenticity: Creating assessments that authentically describe innovative thinking can be challenging because traditional testing methods may not adequately assess creative problem solving (Heneberg et al., 2016). Cultural change: overcoming entrenched educational norms and fostering a culture of innovation among students and teachers requires time and commitment (Lackéus, 2015).

2) Opportunities:

Interdisciplinary collaboration: Innovation encourages interdisciplinary collaborationand fosters a dynamic learning environment that mirrors real projects (Heneberg et al., 2016). Global perspective: Innovation promotes an international mindset as students learn to solve problems with global impact (Rasmussen et al., 2018). Industrial partnerships: collaboration with industries offers opportunities for real projects, mentoring and exposure to current trends (Lackéus, 2015). Entrepreneurial Mindset: Fostering innovation aligns with an entrepreneurial mindset and equips students with skills to navigate the evolving job market (Kuratko, 2005). Solving real-world problems: an innovation-based curriculum allows students to work on real-world challenges, improving their ability to apply knowledge to practical situations (Rasmussen et al., 2018). Development of soft skills: Innovative approaches develop communication, teamwork and critical thinking, providing students with multifacetedskills (Fayolle and Gailly, 2008).

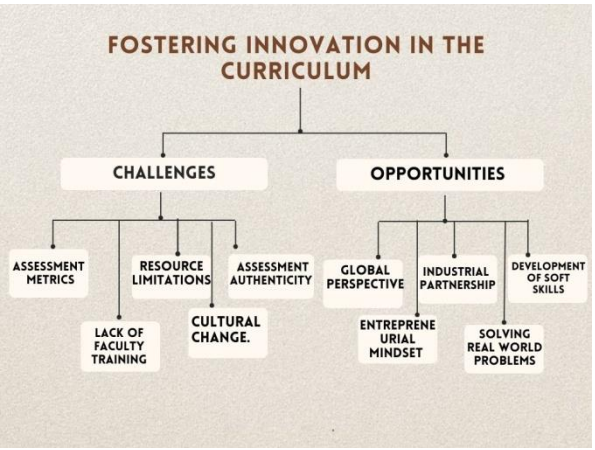

Fig2: Challenges and Opportunities to foster innovation in the curriculum

By addressing challenges such as the authenticity of assessment, ongoing evaluation, cultural change, Institution commitment, collaboration with stockholders can take advantage of opportunities to solve real-world problems and develop key soft skills, contributing to a more dynamic entrepreneurship learning environment (Sibanda, M., & Naidoo, P. 2023).

D. *RECOMMENDATIONS FOR EFFECTIVE PROMOTION OF ENTREPRENEURSHIP IN ENGINEERING PROGRAMS*:

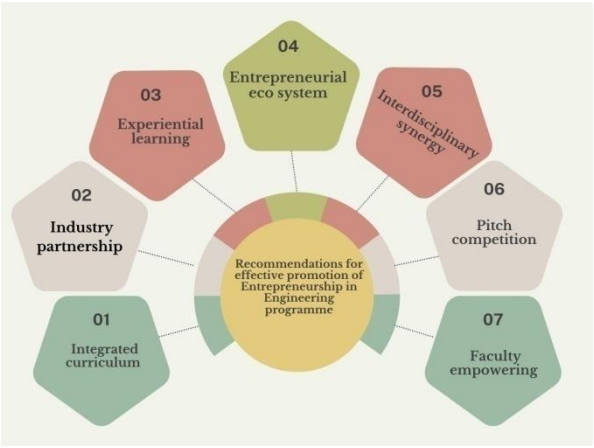

Fig 3: Recommendations for effective promotion for Entrepreneurship in Engineering Programme.

Integrated Curriculum: Seamlessly integrate entrepreneurship concepts into engineering curricula so that students see business skills as an integral part of their education (Fayolle and Gailly, 2008). Experiential Learning: Include hands-on experiences such as start-up projects, design challenges and internships to provide students with hands-on exposure to entrepreneurship (Lackéus, 2015). Industry Partnerships: Work with industry partners to provide real-world projects, mentoring and networking opportunities, bridging the gap between

academia and business (Rasmussen et al., 2018). Strategic Courses: Introduce specialized courses that focus on aspects of business, such as business planning, marketing, finance and intellectual property, which provide students with essential business knowledge (Kuratko, 2005). Entrepreneurial Ecosystem: Create a nurturing ecosystem that nurtures innovation, including incubators, accelerators and networking events. Such an environment encourages students to come up with ideas, experiment and refine their concepts (Henneberg et al., 2016). The prototype environment should be incorporated into the incubation and innovation hub, which includes regular training, internships, strong mentorship and coaching programs and a clear exit strategy that can improve incubates' entrepreneurial skills and capabilities. (Kabelele, D., Banele, S., & Gomera, W. 2023). Interdisciplinary Synergy: Facilitates interdisciplinary collaboration that encourages interaction between engineering students and students from different disciplines. This practice cultivates different perspectives and innovative problem-solving methods (Lackéus, 2015). Mentoring initiatives: Develop mentoring programs that connect students with qualified entrepreneurs who can provide guidance, knowledge and valuable industry connections and nurture promising entrepreneurial talent (Rasmussen et al., 2018). Pitch Competitions: Host pitch competitions where students can pitch their inventive ideas to a panel of judges. This exercise perfects their presentation skills and makes them evaluate in reality (Henneberg et al., 2016). Faculty Empowerment: Provide faculty with specialized training and resources to skillfully share entrepreneurship concepts and guide students in their entrepreneurship (Fayolle and Gailly, 2008). Foster an encouraging climate: foster a culture that values risk, sees failure as learning opportunities and encourages ambitious entrepreneurial endeavors (Kuratko, 2005).

By following these recommendations, institutions can foster an entrepreneurial environment for engineering students that equips them with the skills, knowledge, and practical experience needed to succeed in the dynamic fields of innovation and entrepreneurship.

VI. CONCLUSION

These article highlights, fostering innovation, fostering entrepreneurship and fostering a startup mindset are of utmost importance. Today's engineers require not only technical skills, but also the ability to think creatively, adapt quickly and collaborate across disciplines. This study clarified the meaning of these concepts without the help of quantitative or qualitative analysis. Drawing on experiential insights and established educational theories, it explored how integrating entrepreneurship into engineering education can foster creativity, interdisciplinary collaboration and industry capability. Challenges and opportunities related to this integration have been examined, which sheds light on potential roadblocks and at the same time offers opportunities for meaningful change. By encouraging entrepreneurship, educators can prepare engineering students to be problem solvers, innovators, and influencers of social progress.

Teacher training programs, entrepreneurship development initiatives, and stakeholders involvement have a positive role to support and developing students entrepreneurship competencies. It is imperative that engineering education continuously evolves and takes a holistic approach that goes beyond technical knowledge. Such an approach makes graduates not only successful in their careers, but also significantly contributes to the development of society as a whole (DeCoito, I., & Briona, L. K. 2023).

VII. LIMITATIONS

Limitations of a study are factors that may affect the scope, reliability and applicability of its results. These include the use of qualitative methods that maylack the statistical power of quantitative analysis. The scope of the study may not cover all aspects comprehensively due to limitations. Lack of quantitative data can prevent accurate measurement of results. Depending on published sources, this can be misleading. The ever-changing nature of the industry may make the conclusions less relevant over time. Finally, qualitative analysis is open to interpretation, which can lead to bias. Despite these limitations, the study offers insights but should be considered within its limitations.

VIII. FUTURE RESEARCH

Future research in the field could focus on quantifying the actual effects of incorporating entrepreneurship into technology education through quantitative analysis. Longitudinal studies could track graduates' career paths and contributions to innovation, which would provide insight into the lasting effects of entrepreneurship education. Cross-cultural comparisons can shed light on how regional context influences the implementation and results of entrepreneurial concepts. Researching innovative teaching strategies to promote entrepreneurial

thinking in various technological domains can improve pedagogical approaches. Examining the results of collaboration with entrepreneurial industries can provide practical insights for effective integration. In addition, the development of standardized metrics to measure the development of engineering students' entrepreneurial skills could facilitate continuous evaluation and improvement.

REFERENCES

Audretsch, D. B., Link, A. N., & Scott, J. T. (2018). "Public/private technology partnerships: Evaluating SBIR-supported research." Research Policy, 47(1), 139-147.

Babu, D. R., Goli, G., Rao, K. V., & Rao, N. S. (2023). Effectiveness n Online Professional i Education: Influences of Technology, Lms, Personal Factors and Teaching Aids. Journal of Engineering Education Transformations, 36(3).

Bigham, A., Davies, I., & Riley, M. (2020). "Virtual entrepreneurship education: Engaging students and stimulating entrepreneurial intentions." Education and Training, 62(4), 363-376.

Birla Institute of Technology and Science, Pilani. (n.d.). "Practice School." Retrieved from https://www.bits-pilani.ac.in/pilani/practiceschool/PracticeSchool

Brown, T., & Wyatt, J. (2010). "Design thinking for social innovation." Stanford Social Innovation Review, 8(1), 30-35.

DeCoito, I., & Briona, L. K. (2023). Fostering an entrepreneurial mindset through project-based learning and digital technologies in STEM teacher education. In Enhancing entrepreneurial mindsets through STEM education (pp. 195-222). Cham: Springer International Publishing.

Drucker, P. F. (1985). "Innovation and entrepreneurship: Practice and principles." HarperBusiness.

Dweck, C. S. (2006). "Mindset: The new psychology of success." Random House.

E. Ramesh, D. Ramesh Babu and P. Ramchandar Rao, "The Impact of Project Management in Achieving Project Success- Empirical Study", International Journal of Mechanical Engineering and Technology,(2018), vol.9, no.13,pp.237-247.

Fayolle, A., & Gailly, B. (2008). From craft to science: Teaching models and learning processes in entrepreneurship education. Journal of European Industrial Training, 32(7), 569-593.

Feld, B. (2012). "Startup communities: Building an entrepreneurial ecosystem in your city." John Wiley & Sons.

Fiet, J. O. (2000). "The systematic search for entrepreneurial discoveries." Academy of Management Review, 25(1), 200-211.

Goli, G., Babu, D. R., Laxmi, M. R., Kafila, K., & Rao, N. S. (2022, May). Image capturing and audio-video production to make five-shot and short film projects. In AIP Conference Proceedings (Vol. 2418, No. 1). AIP Publishing.

Gurunadham, D. Goli, chapala. Nageswara Rao.(2020). Application of Artificial Intellegence on HRM for Green Business. International Journal of Advanced Science and Technology, 29(06), 2898-

Henneberg, S. C., Mouzas, S., & Naudé, P. (2016). Entrepreneurship and Innovation: New Entries, Survival, Growth. Industrial Marketing Management, 53, 1-6.

IIM Bangalore. (n.d.). "NS Raghavan Centre for Entrepreneurial Learning (NSRCEL)." Retrieved from https://www.iimb.ac.in/nsr

IIT Bombay. (n.d.). "Entrepreneurship Development Cell."Retrieved from https://edc.som.iitb.ac.in/

Isenberg, D. (2010). "How to start an entrepreneurial revolution." Harvard Business Review, 88(6), 40-50.

Kabelele, D., Banele, S., & Gomera, W. (2023). Innovation hub a venture for students' entrepreneurial talents: a case of college of business education. International Journal of Research in Business and Social Science (2147-4478), 12(5), 362-371.

Kolb, D. A. (1984). "Experiential learning: Experience as the source of learning and development."Prente Hall.Entrepreneurship Theory and Practice, 41(6), 1029-1055.

Kuratko, D. F. (2005). The emergence of entrepreneurship education: Development, trends, and challenges. Entrepreneurship Theory and Practice, 29(5), 577-598.

Lackéus, M. (2015). Entrepreneurship in Education: What, Why, When, How. OECD Education Working Papers, No. 127, OECD Publishing.

Leshner, G., & Laskowska, B. (2017). "Bridging the Gap between Engineering Education and Practice: A Study of Experiential Learning." European Journal of Engineering Education, 42(3), 338-352.

Mair, J., & Marti, I. (2006). "Social entrepreneurship research: A source of explanation, prediction, and delight." Journal of World Business, 41(1), 36-44.

Matlay, H. (2008). "The impact of entrepreneurship education on entrepreneurial outcomes." Journal of Small Business and Enterprise Development, 15(2), 382-396.

Mora, A., & Kettinger, W. J. (2018). "Gamification: A new paradigm for education?" Journal of Information Systems Education, 29(1), 15-23.

Nambisan, S. (2017). "Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship."

National Academy of Engineering. (2004). The Engineer of 2020: Visions of Engineering in the New Century. National Academies Press.

Neck, H. M., & Greene, P. G. (2011). "Entrepreneurship education: known worlds and new frontiers." Journal of Small Business Management, 49(1), 55-70.

Rasmussen, E., Mosey, S., & Wright, M. (2018). The Influence of University Departments on the Evolution of Entrepreneurial Competencies in Spin-off Ventures. Entrepreneurship Theory and Practice, 42(2), 222-244.

Sarasvathy, S. D. (2001). "Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency." Academy of Management Review, 26(2), 243-263.

Sibanda, M., & Naidoo, P. (2023, November). Building an Entrepreneurial Culture in Electrical Engineering Education. In The 10th Focus Conference (TFC 2023) (pp. 235-251). Atlantis Press.

UNESCO. (2015). Rethinking Education: Towards a Global Common Good? UNESCO Publishing.

Zaki, Y., Al Muwali, A., & Mahdi, N. (2021). The Role of Nurturing Technopreneurship Education and Building University Students' Entrepreneurial Mindsets and Skill Sets in Fostering Digital Innovation and Augmenting the Tech Start-Up Ecosystem in Bahrain. International Journal of Learning, Teaching and Educational Research, 20(6), 152-173.