

Using design thinking in climate friendly entrepreneurship education to foster SDGs

Nurul Aini^{1*}, Gadis Febriani², and Aurora Diordaiva Zahira Shafa³

^{1,3}Department of Digital Business, Bina Nusantara University, Jakarta, Indonesia

²Department of Visual Communication Design, Bina Nusantara University, Jakarta, Indonesia

Abstract. Entrepreneurship education is a crucial area of education to develop to support the achievement of the SDGs. Exploring various approaches and methods is crucial to making entrepreneurship education more responsive to global challenges, particularly those related to environmental and energy sustainability. Climate-friendly entrepreneurship education based on design thinking is a viable alternative learning medium for developing climate-friendly entrepreneurship because it encourages innovative problem-solving and addresses market needs while still maintaining environmental sustainability, providing social benefits, and generating financial returns.

1 Introduction

In facing various global climate challenges, entrepreneurship education must apply the principles of the Sustainable Development Goals with a focus on how new businesses can make a real contribution to solving increasingly massive climate change. An essential aspect of this development involves the exploration and implementation of various pedagogical approaches. Among the methodologies increasingly adopted in entrepreneurship education is design thinking, which serves as a tool for fostering innovative problem-solving processes [1]. This is in line with the concept of business, which has the core of solving problems faced by consumers by providing goods or services.

Design thinking is widely recognized as a complex cognitive framework that facilitates understanding of new realities and integrates design methodologies into fields such as business and innovation [2]. By combining analytical and creative aspects, design thinking helps individuals and organizations to understand the complexity of problems and identify new opportunities in a dynamic business environment. Its relevance in entrepreneurship education has gained momentum, particularly in parallel with the growing popularity of the lean startup approach, which emphasizes opportunity creation and iterative innovation in business development [3]. In the context of entrepreneurship education, design thinking provides an effective framework for students to learn through

* Corresponding author: nurul.aini001@binus.ac.id

an exploratory and experiential process. The application of design thinking in entrepreneurship education contributes to the development of innovative mindsets and more holistic problem-solving skills. A growing body of empirical studies supports the application of design thinking as a pedagogical model in entrepreneurship education [4]. Entrepreneurship education plays a pivotal role in business schools, both in developed and developing economies [5]. Entrepreneurship education serves not only as an academic discipline, but also as a transformative approach that shapes students' mindsets in recognizing opportunities and creating value that focuses on strengthening the entrepreneurial ecosystem that encourages job creation and economic growth, in line with national development goals. Entrepreneurs must acquire and continuously develop a set of competencies and qualifications, which can be effectively nurtured through well-designed entrepreneurship education programs [6]. This study argues that a design thinking-based approach presents a viable and promising pedagogical model. By promoting innovative problem-solving and market-responsive solutions, design thinking can significantly enhance the quality and impact of climate friendly entrepreneurship education.

The objective of this study is to develop a learning resource aimed at enhancing climate friendly entrepreneurship education through the integration of a design thinking approach. The significance of this study lies in its potential to foster and strengthen the climate friendly entrepreneurial mindset. By embedding design thinking into the framework of climate friendly entrepreneurship education, the proposed learning resource aspires to encourage innovative problem-solving, user-centered business ideation, and a deeper engagement with entrepreneurial processes—ultimately contributing to the broader national goal of cultivating a new generation of entrepreneurs and still maintaining environmental sustainability, providing social benefits, and generating financial returns.

2 Literature Review

2.1 Design Thinking for Climate Friendly Entrepreneurship Education

The topic of entrepreneurship education has received global attention and is growing rapidly in the field of education [7]. Design thinking for entrepreneurship education in the last 5 years has received a lot of attention from academics who highlight the use of design thinking in entrepreneurship education, especially in developing entrepreneurial capacity and mindset. [8].

In today's dynamic and highly complex world, entrepreneurship education is no longer considered sufficient if it adopts a quantitative, analytical and deductive approach to try to produce businesses that solve complex, unstructured, unclear, ambiguous, holistic and multidisciplinary real-world problems and for this it would be better to use a design-based approach to create unique business opportunities according to the context of the problems faced.

The framework in the design thinking approach for climate friendly entrepreneurship education includes empathy (understanding and observing the user needs), definition of perceived problems, climate friendly ideas for possible solutions, prototyping and testing.

The application of design thinking is carried out repeatedly until a solution is found that is considered most appropriate to answer the existing problem [9]. This is suitable for businesses that are constantly trying to answer market needs by answering consumer problems through solutions that suit consumer preferences.

3 Methods

The research method was conducted using a design thinking approach. The design thinking method was chosen considering that this method is able to provide potential solutions to a problem by providing better products and services, increasing productivity and operational improvements. According to the Institute of Design at Stanford, design thinking consists of 5 stages, where each stage in this research will be explained in the following figure:

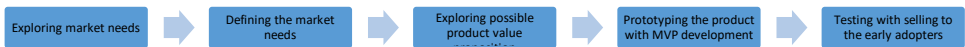


Fig. 1. Design thinking process

The research uses literature study analysis to find each step in each design thinking process in the entrepreneurship learning process.

4 Results

4.1 Empathize : exploring market needs

The first step in the process begins with exploring the target market's needs. To understand this, you can use the Empathy Map tool. Empathy maps are used to deeply understand the perspectives, experiences, needs, and motivations of the audience, not just at the level of assumptions in a specific problem situation [10]. An empathy map works by mapping everything the target market sees, hears, thinks, feels, says, and does, while simultaneously identifying the triggers for their fears, frustrations, desires, and happiness. This entire process allows entrepreneurs to build empathic understanding within the situational context, enabling them to provide solutions in the form of products or services that are relevant to the target market's lifestyle and aligned with their values and expectations. In a business context, this approach can uncover latent needs—needs not yet directly expressed by the target market—and prevent entrepreneurs from biasing their thinking when formulating problems or solutions to offer to the target market [11]. The following empathy map canvas can be used to explore target market needs :

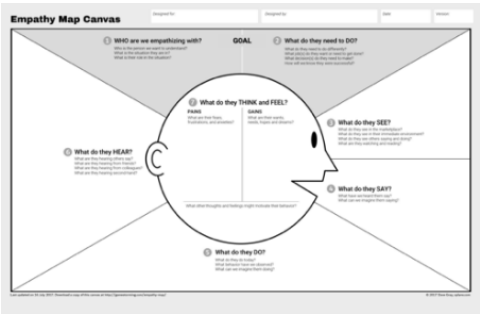


Fig. 2. Empathy map canvas

Thus, empathy maps are not just visualization tools, but strategic means to integrate target market perspectives in decision-making, improve the accuracy of problem identification, and ultimately create products or services that are truly valuable to users.

4.2 Define : Defining the market needs

The second process continues with determining market needs. To determine market needs, you can use the Problem Statement Canvas (PSC) [12]. The PSC is a strategic tool that helps define market needs in a structured manner by mapping the problems faced by customer segments. This process begins by identifying the time when the problem occurred, allowing for contextual and situational understanding. Next, the process explores the root causes of the problems experienced by the target market.

THE PROBLEM STATEMENT CANVAS

STARTUP NAME [Type here]

DATE [Type here]

VERSION [Type here]

CONTEXT When does the problem occur? [Type here]	PROBLEM What is the root cause of the problem? [Type here]	ALTERNATIVES What do customers do now to fix the problem? [Type here]
CUSTOMERS Who has the problem most often? [Type here]	EMOTIONAL IMPACT How does the customer feel? [Type here] QUANTIFIABLE IMPACT What is the measurable impact? (include units) [Type here]	ALTERNATIVE SHORTCOMINGS What are the disadvantages of the alternatives? [Type here]

Fig. 3. The problem statement canvas

The PSC contains an emotional impact that often triggers purchasing decisions. Furthermore, alternatives are presented, indicating the competitors chosen by customers. These alternatives are also accompanied by their respective shortcomings, which can provide opportunities for improvement and provide better solutions. The quantifiable impact section is used to objectively establish market value using numerical data to rationally determine the benefits of using the offered solution. Examples of quantifiable impacts include time savings, cost savings, or increased productivity. By integrating the rational and emotional perspectives of customers, the PSC produces a complete picture of market needs, including both real and latent needs. This approach increases the

accuracy of problem understanding and ensures that the developed solution is relevant, valuable, and competitive in the target market.

4.3 Ideate : Exploring possible climate friendly value proposition

The third process is exploring possible product value propositions which will be carried out using the value proposition canvas. This is done by connecting a deep and comprehensive understanding of the problem that has been defined in the previous stage with the design of a solution that is valuable for users. VPC was introduced by Osterwalder where the first process is carried out by mapping customer profiles with a value map. Customer profiles include jobs (identifying the work that customers must complete), pains (identifying obstacles, frustrations and risks experienced) and gains (identifying benefits, good results desired by customers). Meanwhile, for the value map, it consists of products & services (ideas for the main offering), pain relievers (ideas for how to reduce customer obstacles), and gain creators (ideas for how to create additional benefits). To generate a climate-friendly value proposition in every product produced, the resulting value map must result in pain relief and gain creators who provide benefits to the environment and society. The core principle of this exploration is to achieve problem-solution fit, ensuring that the elements of the value proposition directly respond to customer priorities while still paying attention to environmental sustainability and providing social impact.

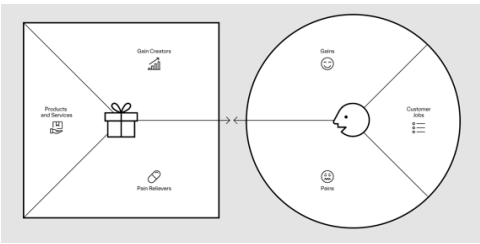


Fig. 4. Value proposition canvas

4.4 Ideate : Exploring possible climate friendly value proposition

The fourth process is prototyping, which involves developing a minimum viable product (MVP). This is a product version that allows for a full Build-Measure-Learn cycle with minimal development effort and time. In this case, it's crucial to create a product as simple as possible while remaining functional, allowing developers to quickly test it by offering it for user adoption. Therefore, prioritizing MVP functionality is crucial [13]. An MVP essentially defines the type of service offered and thus enables early sales. Previous research has found that creating an effective MVP to test product ideas and determine product-market fit can foster a constructive startup ecosystem in software startups [14]. MVPs can be implemented using online prototyping tools such as Figma, Adobe, Sketch, Marvel, or Axure.

4.5 Test : Testing with selling to the early adopters

Continuing the fourth process, MVP development continues with direct sales to the target market. From there, developers will receive user feedback in the form of adoption interest, as evidenced by sales of the solution offered, and feedback on service improvements.

5 Discussion and conclusion

This research demonstrates the importance of balancing empathetic research, structured analysis, climate friendly value proposition formulation, and practical validation throughout each stage of design thinking. This research generates a structured methodological framework for building a business based on market needs and relevant solutions. Understanding market needs, both behaviorally and psychologically, such as motivation and emotions, early on is key to delivering solutions that align with the target market's purchasing decisions. Empathy mapping measures this qualitatively, combined with the PSC, which defines the problem concretely and quantitatively, creating a more powerful combination. By understanding both implicit and explicit market needs, solutions can be formulated using VPC tools, focusing on how the solution addresses core needs (jobs), addresses pains, and provides desired benefits (gains), achieving alignment between problem and solution, known as problem-solution fit while still paying attention to environmental sustainability and providing social impact. Prototyping using the MVP approach provides true validation, where ideas are tested by selling directly to the target market, with low risk and the potential for high feedback. High fidelity, where possible, can be an option to provide in-depth testing of the proposed solution. By using MVP, it is hoped that alignment between the solution and the market will be achieved, also known as product-market fit. The climate friendly entrepreneurship education process can be implemented by the design thinking approach.

To specifically, supporting educators in adopting design thinking in climate-friendly entrepreneurship education requires concrete, applicable pedagogical steps. Educators can take the initial step of framing authentic, relevant, and local environmental issues as key challenges for student inquiry, enabling learning within a realistic, intuitive context. Throughout the learning process, educators should adopt a facilitator mindset that facilitates exploration, experimentation, and iterative learning. To help students internalize the connection between design thinking and sustainable entrepreneurial action, educators can have students use reflective journals. By combining the design process with a risk-taking framework, educators can teach students the creativity, empathy, and analytical skills necessary to propose innovative, climate-friendly business solutions.

The application of a design thinking approach to climate-friendly entrepreneurship education has the potential to face obstacles and challenges that must be anticipated. Some common obstacles and challenges relate to limited resources and budgets, for example, for observation and prototyping, and access to collaborative networks. Educators may face challenges when shifting from traditional lecture-based learning to an experiential, iterative, and student-centered learning model. The integration of

climate-focused content adds significant challenges, as students may lack foundational knowledge in sustainability science or struggle to evaluate the environmental impacts of proposed solutions. Collectively, these obstacles highlight the need for strategic planning, capacity building, and a supportive institutional environment to effectively integrate design thinking into climate-friendly entrepreneurship education.

Acknowledgement. This work is supported by Bina Nusantara University as a part of Bina Nusantara University's BINUS Research for Early Career Researchers entitled Building Design Thinking Education Website for Entrepreneurship Education with contract number: 080/VRRTT/IV/2025 and contract date 25 April 2025. Data availability : all the data already exist in the paper. Author Contributions : The following statements were used : Conceptualization, NA; Methodology, NA; Resource and data curation, GF and ADZS; Visualization, GF; Writing, NA; Review, GF.

References

1. A.D. Daniel, Fostering an entrepreneurial mindset by using a design thinking approach in entrepreneurship education. *Ind. High. Educ.* **30**, 215–223 (2016).
<https://doi.org/10.1177/0950422216653195>
2. E. Val, I. Gonzalez, I. Iriarte, A. Beitia, G. Lasa, M. Elgoro, A design thinking approach to introduce entrepreneurship education in European school curricula. *Des. J.* **20**, S754–S766 (2017). <https://doi.org/10.1080/14606925.2017.1353020>
3. M. Garbuio, A. Dong, N. Lin, T. Tschang, D. Lovallo, Demystifying the genius of entrepreneurship: How design cognition can help create the next generation of entrepreneurs. *Acad. Manag. Learn. Educ.* **17**, 41–61 (2018).
<https://doi.org/10.5465/amle.2016.0040>
4. M. Lynch, U. Kamovich, K.K. Longva, M. Steinert, Combining technology and entrepreneurial education through design thinking: Students' reflections on the learning process. *Technol. Forecast. Soc. Change* **164**, 119689 (2021).
<https://doi.org/10.1016/j.techfore.2020.119689>
5. K. Anubhav, A.K. Dwivedi, A. Kumar, Entrepreneurship education in higher education (2002–2022): A technology-empowered systematic literature review. *Int. J. Manag. Educ.* **22**, 100993 (2024). <https://doi.org/10.1016/j.ijme.2024.100993>
6. A. Carpenter, R. Wilson, A systematic review looking at the effect of entrepreneurship education on higher education student. *Int. J. Manag. Educ.* **20**, 100541 (2022).
<https://doi.org/10.1016/j.ijme.2022.100541>
7. K. Fellnhofer, Toward a taxonomy of entrepreneurship education research literature: A bibliometric mapping and visualization. *Educ. Res. Rev.* **27**, 28–55 (2019).
<https://doi.org/10.1016/j.edurev.2018.10.002>
8. D.A. Johann, A.D. Nunes, G.B. Santos, D.J. Silva, S.A. Bresciani, L.F. Lopes, Mapping of scientific production on design thinking as a tool for entrepreneurship education: A bibliometric study of a decade. *World J. Entrep. Manag. Sustain. Dev.* **16**, 271–285 (2020). <https://doi.org/10.1108/WJEMSD-12-2019-0100>
9. R. Glen, C. Suci, C.C. Baughn, R. Anson, Teaching design thinking in business schools. *Int. J. Manag. Educ.* **13**, 182–192 (2015).
<https://doi.org/10.1016/j.ijme.2015.05.001>

10. P. Cairns, I. Pinker, A. Ward, E. Watson, A. Laidlaw, Empathy maps in communication skills training. *Clin. Teach.* **18**, 142–146 (2021).
<https://doi.org/10.1111/tct.13255>
11. R. Srinivasan, B.S.M. González, The role of empathy for artificial intelligence accountability. *J. Responsible Technol.* **9**, 100021 (2022).
<https://doi.org/10.1016/j.jrt.2021.100021>
12. B. Aulet, *Disciplined entrepreneurship: 24 steps to a successful startup, expanded & updated* (John Wiley & Sons, 2024).
13. K. Saarni, M. Kauppinen, T. Männistö, Impact of minimum viable product on software ecosystem failure. *Inf. Softw. Technol.* **178**, 107612 (2025).
<https://doi.org/10.1016/j.infsof.2024.107612>
14. N. Tripathi, M. Oivo, K. Liukkunen, J. Markkula, Startup ecosystem effect on minimum viable product development in software startups. *Inf. Softw. Technol.* **114**, 77–91 (2019). <https://doi.org/10.1016/j.infsof.2019.06.007>