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Implementation of the Design Thinking Model in Entrepreneurship Learning at Senior High School

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A B S T R A C T

This case study evaluates the implementation of Design Thinking-based entrepreneurship learning in fostering deep learning and 21st-century skills at SMA XYZ South Tangerang. As a human-centered, iterative problem-solving approach, Design Thinking is considered important in entrepreneurship education because it trains students to identify authentic opportunities, tolerate risk, and learn through failure-dispositions central to entrepreneurial success. Design Thinking is therefore regarded not merely as a design methodology, but as a pedagogical vehicle for cultivating an entrepreneurial mindset. A single case study approach was used, with data collected through interviews, classroom observations, a focus group discussion (FGD) with eleven teachers, a student survey (n = 141), and document analysis. Findings show that Design Thinking was implemented systematically through the empathize, define, ideate, prototype, and test stages, integrated into intracurricular and cocurricular activities, particularly the Entrepreneurship Week program. The learning process fostered deep learning through mindful, meaningful, and joyful learning, and significantly developed 21st-century skills: collaboration (94%), creativity (92%), communication (90%), and critical thinking (90%). Design Thinking-based entrepreneurship learning is concluded to be effective in creating meaningful, contextual, and engaging learning experiences relevant to 21st-century education demands.

Keywords: *Design Thinking, Deep Learning, Entrepreneurship Education, 21st-Century Skills, Case Study*

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INTRODUCTION

Twenty-first-century education demands that learners possess critical, creative, collaborative, and communicative thinking (the 4Cs), along with adaptability and problem-solving skills. Entrepreneurship learning is regarded as highly relevant to these demands, and SMA XYZ South Tangerang has positioned Design Thinking-based entrepreneurship learning as one of its flagship programs, in line with the school's *five beliefs* philosophy. For the past five years, the school has consistently applied the five iterative stages of the Design Thinking model *(empathize, define, ideate, prototype,* and *test)* in entrepreneurship learning. The model trains students to learn through failure, strengthens resilience, and encourages the identification of business opportunities through deep empathy toward user needs. This alignment is well-documented in the literature: as a human-centered, iterative problem-solving approach (Brown, 2009), Design Thinking equips learners to identify authentic problems and opportunities, test ideas through rapid prototyping, and adapt in response to feedback and failure (Razzouk & Shute, 2012)-competencies that mirror the core practices of real-world entrepreneurs and that (Kuratko, 2020) identifies as central to entrepreneurial character, namely opportunity recognition, risk-taking, and independence. Design Thinking is therefore considered important in entrepreneurship education not merely as a design methodology, but as a pedagogical vehicle for cultivating an entrepreneurial mindset. Entrepreneurship subject scores for Cohort XIV (2023-2026) show a consistently high and improving trend, from an average of 89.44 in the first semester to 93.04 in the sixth semester, indicating that student understanding deepened over time.

This research is further motivated by national employment conditions: data from Statistics Indonesia (BPS) in August 2024 indicate that 79.90% of unemployed youth are educated, and senior high school graduates account for 28% of national unemployment as of BPS data from January 2026. This gap between education and labor market needs reinforces the urgency of instilling an entrepreneurial mindset from the senior high school level onward. Entrepreneurship learning is not merely intended to produce entrepreneurs, but to cultivate a way of thinking that recognizes opportunities, dares to take risks, and persists in the face of challenges.

Despite the school's five years of consistent implementation, three gaps motivate this study: (1) literature on Design Thinking at the secondary education level remains limited and is concentrated mostly on higher education and professional contexts (e.g., (Ericson et al., 2009; Rana et al., 2025) or vocational settings (Roopsuwankun & Woraphiphat, 2023), with none offering a comprehensive, senior-secondary-level evaluation linking implementation to learning outcomes; (2) the entrepreneurship program at SMA XYZ, although structured, has never been comprehensively and academically evaluated; and (3) no comprehensive evaluation instrument yet links the iterative nature of the Design Thinking model with the three pillars of deep learning (mindful, meaningful, and joyful learning). Accordingly, this study addresses five research questions: (1) how is Design Thinking implemented in entrepreneurship learning; (2) how does its implementation foster deep learning; (3) how does it develop entrepreneurial and 21st-century skills; (4) what conditions support successful implementation; and (5) what challenges do teachers and students face.

Constructivism and Experiential Learning

Piaget & Inhelder, (2008) conceptualize learning as an active process in which learners construct their own knowledge through interaction with the environment, reaching the formal operational stage (abstract, analytical thinking) during adolescence. (Vygotsky, 1978) adds a social dimension through the concept of the *Zone of Proximal Development* (ZPD), the distance between a learner's actual ability and the potential achievable through teacher guidance or peer collaboration. Within Design Thinking-based learning, the ZPD is concretely realized through collaborative group work at every stage: empathize trains data collection and critical thinking; define and ideate encourage the exchange of ideas and feedback among members; and prototype and test train higher-order thinking skills through an iterative process of learning from failure. Complementing this, (Kolb, 2014) frames learning as a four-stage cycle-concrete experience, reflective observation, abstract conceptualization, and active experimentation-that is visible when students build a product (concrete experience), discuss the outcome (reflective observation), connect it to marketing theory (abstract conceptualization), and then test a new marketing strategy (active experimentation).

Entrepreneurial learning theory views entrepreneurship education as a dynamic and continuous process in which knowledge and skills are built through direct experience, social interaction, and reflective practice (Rae, 2006). Kuratko (2020) emphasizes three aspects to be developed in entrepreneurship learning: knowledge of core business and entrepreneurship concepts, skills in analysis, decision-making, and problem-solving, and attitudes reflecting entrepreneurial character such as creativity, risk-taking, and independence. At SMA XYZ, this model is realized through authentic projects, from market research and prototype design to marketing, sales, and reflective evaluation, giving students a complete experiential journey through the stages of entrepreneurship.

Deep Learning

The concept of deep learning was first introduced by Marton & Säljö, (1976), who distinguished surface learning (learning to memorize or meet evaluation demands) from deep learning (comprehensively understanding meaning through interconnections between concepts, critical analysis, and reflection). (Biggs, 1996) reinforces this through the principle of constructive alignment-the coherence between learning objectives, activities, and assessment-while Ausubel (1977) emphasizes the importance of connecting new knowledge with students' prior knowledge (meaningful learning). Within the framework of Indonesia's national

education policy toward the Golden Indonesia 2045 vision, deep learning comprises three core principles: min*dful learning (*students' awareness of their own learning process, encouraging reflective thinking and self-regulated learning), me*aningful learning (*learning that connects new knowledge with students' real-life experience and context), and j*oyful learning* (an enjoyable learning atmosphere that fosters intrinsic motivation rather than mere entertainment). These principles align with the development of Higher Order Thinking Skills (HOTS) and the six global competencies proposed by (Fullan & et al., 2018): character, citizenship, collaboration, communication, creativity, and critical thinking.

The Design Thinking Model

Design Thinking originated in the industrial design world at IDEO and was popularized by (Brown, 2009) through *Change by Design*. As a human-centered problem-solving model, Design Thinking directs users to deeply understand human needs before creating solutions, through five iterative stages: (1) *empathize*, understanding user needs, experiences, and problems through observation, interviews, and discussion, which trains social sensitivity and empathy; (2) *define*, analyzing and synthesizing empathize-stage findings to formulate an actionable point of view, training critical-analytical thinking; (3) *ideate*, generating as many creative ideas as possible without initially limiting feasibility, sharpening divergent thinking; (4) *prototype*, turning abstract ideas into concrete, observable, and evaluable forms (models, sketches, mock-ups), training problem-solving and collaboration; and (5) *test*, trialing the prototype with real users to obtain authentic feedback, training openness to critique and continuous evaluation. At SMA XYZ, Design Thinking is integrated across disciplines-Biology, Chemistry, Accounting, Economics, Indonesian, English, and Sociology-with homeroom teachers acting as facilitators who guide students' thinking, reflection, and collaboration processes.

Taken together, the theoretical perspectives discussed above provide a coherent framework for examining Design Thinking-based entrepreneurship learning at the secondary education level. Constructivism and experiential learning explain how students construct knowledge through collaboration, authentic experience, reflection, and experimentation, while entrepreneurial learning theory highlights the development of opportunity recognition, creativity, decision-making, risk-taking, and independence. The deep learning framework further emphasizes that these learning experiences should be mindful, meaningful, and joyful, rather than limited to the acquisition of conceptual knowledge. Within this framework, the five iterative stages of Design Thinking provide a practical pedagogical structure through which these theoretical principles can be enacted in authentic entrepreneurship projects. Accordingly, this study examines how Design Thinking is implemented in entrepreneurship learning, how its implementation supports deep learning and the development of entrepreneurial and 21st-century competencies, and what contextual conditions and challenges shape its implementation at the senior secondary level. This integrated perspective provides the basis for evaluating the school's five-year implementation and identifying its implications for entrepreneurship education.

METHOD

This study employed a single case study design focusing on SMA XYZ South Tangerang. A single-case approach was chosen because the school represents what (Yin, 2003) terms a revelatory case: it is among the few senior high schools to have implemented Design Thinking as a mandatory, school-wide entrepreneurship framework continuously for five years, offering an information-rich context for exploring participants' meanings, experiences, and perceptions in depth-a depth that a multiple-case design would not permit within the scope of this study (Balbach, 1999; Yin, 2003). Over the past five years, the Design Thinking model has become a mandatory learning framework for all students from Grade X to XII, signaling the school's shift from surface learning toward deep learning.

Respondents

Participants were selected through purposive sampling and comprised four groups. Teachers: eleven teachers took part in the FGD (the vice principals for curriculum and facilities, and teachers of entrepreneurship, biology, chemistry, ICT, Indonesian/English, and mathematics), supplemented by an in-depth interview with the coordinator of the social studies teacher group. Students: 141 students (43% of 329 students) from Grades X, XI, and XII, with approximately 10-12 students representing each class. Management: the principal and the vice principal for curriculum, as sources of information on school policy and vision. Alumni: three graduates from three different cohorts, each of whom had served as a project group leader, a student council/Entrepreneurship Week committee member, and an entrepreneurship mentor currently running their own business.

Instruments

Data were collected using four complementary techniques: in-depth interview guides for the principal, vice principal, subject coordinator, teachers, students, and alumni; classroom observation guides used across Grades X-XII during entrepreneurship learning and cross-subject collaborative projects; a document analysis checklist covering achievement scores, lesson plans, Entrepreneurship Week documentation, and student work products; and a five-point Likert-scale student survey (Strongly Disagree to Strongly Agree) measuring student engagement, learning experience with Design Thinking, and 21st-century skills development.

Procedures

In-depth interviews served as the primary technique for exploring the perspectives of the principal, vice principal, subject coordinator, teachers, students, and alumni regarding their experience of participating in or managing Design Thinking-based learning; alumni interviews specifically captured reflective perspectives on the learning's long-term relevance, given their transition into higher education or the workforce. Classroom observations were conducted from Grades X to XII during entrepreneurship learning and cross-subject collaborative projects to capture teacher-student interaction, the application of the Design Thinking stages, and natural classroom dynamics. Document analysis covered student achievement scores, lesson plans, teaching materials, Entrepreneurship Week documentation, and student work products as authentic evidence of curriculum implementation. The FGD with eleven teachers (nine teachers and two vice principals) was conducted on Wednesday, 4 March 2026, from 16.00 to 17.30 in room E203. A supplementary descriptive student survey was administered to enrich data triangulation.

Data Analysis

Data were analyzed through three steps: data reduction (filtering and categorizing data based on initial themes), data display (in the form of matrices, summary tables, thematic narratives, and simple descriptive statistics for survey data), and conclusion drawing/verification (through cross-source triangulation). Source triangulation involved the principal, vice principal, teachers, students, and alumni, while method triangulation combined in-depth interviews, the FGD, observation, and the student survey.

FINDINGS AND DISCUSSION

Implementation of the Design Thinking Model (Research Question 1)

Design Thinking has been introduced since Grade X and applied systematically and continuously through its five stages (empathize, define, ideate, prototype, test), integrated across subjects (Biology, Chemistry, Sociology, Indonesian, ICT, and others) through projects such as fermentation-based healthy food innovation and the cocurricular Entrepreneurship Week program. The prototype stage was regarded as the most engaging by students because it provided space for creativity, while the test stage was found most challenging as it demanded the ability to receive and act on user feedback. A Grade 12 student explained, "The prototype stage was very interesting because I had the opportunity to try designing my

product repeatedly, and I eventually succeeded in designing the best prototype based on the idea agreed upon by our team." A teacher who participated in the FGD explained, "The testing stage really requires facilitator guidance because students still find it difficult to identify the crucial problem and analyze it, so facilitator mentoring is needed."

Classroom observations (February-March, 2026) across Grades X, XI, and XII revealed a similar pattern but with grade-specific themes: Grade X addressed sustainable lifestyle issues and waste-to-recycled-product processing; Grade XI developed local culinary business ideas as a means of promoting regional culture; and Grade XII integrated Design Thinking with chemistry in a school examination, covering marketing strategy and business presentation. Teachers played a dialogic facilitator role, posing probing questions rather than giving direct answers, and collaborated across subjects through five steps: mapping learning outcomes, aligning content, co-designing projects, obtaining principal approval, and implementation.

Table 1. Student Survey Results on the Design Thinking Stages

Stage	Indicator	Mean Score	Interpretation
Empathize	Understanding user needs before determining a product idea	4.7	Strongly agree
Define	Actively involved in formulating the problem	4.5	Strongly agree
Ideate	Actively generating creative ideas	4.6	Strongly agree
Prototype	Actively involved in creating and testing the prototype	4.6	Strongly agree
Test	Actively engaged in trialing the product with prospective users	4.3	Strongly agree

Fostering Deep Learning (Research Question 2)

Mindful learning recorded a mean score of 4.6 (92% of students), reflecting a strong understanding of learning objectives. The principal stated that Design Thinking trains students to think more systematically, and teachers in the FGD observed students beginning to reflect on and improve their own work-an indication of metacognitive awareness. *Meaningful learning* recorded a mean score of 4.4 (88% of students), showing that students perceived a strong connection between learning and real-life problems; 14% were undecided and 1.2% disagreed, mainly because project themes did not always align with personal interests. The social studies coordinator and teachers confirmed that students were able not only to understand concepts but also to generate and present applicable ideas. *Joyful learning* recorded a mean score of 4.3 (87% of students), reflecting high enthusiasm, particularly at the prototype stage, which students considered the most exciting because they could create their own product; about 12% were undecided and 1.4% disagreed, influenced by uneven group dynamics in some projects.

Participant voices reinforced these quantitative findings. The principal noted, "Through Design Thinking, students are trained to think critically, communicate, and work together to solve real problems." A student described the prototype stage as the most exciting part: "Prototyping is the most fun because we get to turn our ideas into our own product," while the test stage was felt to be more demanding: "Testing is quite difficult because we have to face many opinions from users." A teacher in the FGD emphasized the importance of the early stages: "These early stages are actually the most important, but students often want to jump straight to a product idea without first understanding the problem." Alumni offered longer-term reflections, such as: "I got used to understanding the problem first before looking for a solution, and that has been very helpful in college and at work," and "Teamwork and collaboration have really helped me now in college and in organizations."

Student engagement was analyzed through three indicators: enthusiasm (mean 4.3), active participation in group work (75.4% strongly agreed they collaborated well, mean 4.3), and creativity/activeness in seeking solutions (68.3% strongly agreed they were encouraged to think creatively). These findings mark a shift from teacher-centered toward student-

centered learning that is more lively and participatory, with students actively constructing knowledge through experience rather than passively receiving information.

Development of Entrepreneurial and 21st-Century Skills (Research Question 3)

Table 2. Student Survey Results on 21st-Century (4C) Skills

4C Aspect	Indicator	Mean Score	Percentage
Collaboration	Learning to work together to complete the project	4.7	94%
Creativity	Encouraged to think creatively in finding solutions	4.6	92%
Communication	Accustomed to discussing and conveying opinions	4.5	90%
Critical Thinking	Learning to solve problems independently/in teams	4.5	90%

Collaboration skills (94%) developed through teamwork throughout the projects and were reinforced by alumni experience in college and organizational settings. Creativity (92%) grew through the ideate and prototype stages. Communication (90%) was honed through group discussions and project presentations, which alumni reported were highly beneficial for presentations at university. Critical thinking (90%) was reflected in students' ability to analyze problems and formulate solutions systematically, consistent with Dewey's (1986) view that critical thinking and problem-solving are complementary higher-order cognitive processes. All indicators fell in the high category, confirming that the Design Thinking model effectively shapes the 4C skills comprehensively-not only cognitive mastery of concepts but also affective dimensions through students' emotional engagement, an effect that alumni reported persisting well beyond graduation, including in the form of resilience in facing failure. A Grade 12 student shared, "When learning through a systematic, group-based model, my public speaking and creativity improved—I could present better, and I also became braver to try new things I had never done before, such as designing a product." An alumnus recalled, "It was easier for me to collaborate with new university classmates, because I had already been trained since senior high school to work on projects in groups, develop ideas, and turn those ideas into products."

Long-term impacts reported by alumni included: the formation of a critical, solution-oriented mindset, in which Design Thinking changed how alumni approached understanding a goal before seeking a solution; the continued use of 21st-century skills-communication, collaboration, critical thinking, creativity, and problem-solving-in college and work; greater readiness to face higher education and employment, as presentation and decision-making experience gained in senior high school eased their adaptation; greater mental resilience in facing failure and challenges; and a strong sense that the learning was relevant to real life, including in running their own businesses.

Supporting Factors and Implementation Challenges (Research Questions 4 and 5)

Five interrelated factors supported successful implementation: integrated curricular support between intracurricular and cocurricular activities, with learning designed continuously and culminating in the cocurricular Entrepreneurship Week project; the teacher's role as facilitator, guiding without giving direct answers and supporting a student-centered approach; interdisciplinary collaboration, which helped students view problems from multiple disciplinary perspectives; a school culture that supported exploration and courage to try, creating a safe learning environment for innovation and failure; and the sustained long-term impact on students' mindset that reinforced the value of continued implementation. Interdisciplinary collaboration itself followed five structured steps: teachers mapped each subject's learning outcomes and objectives; teachers with aligned content and outcomes collaborated on joint projects or structured assignments; teachers discussed and designed the

tasks and projects together, determined collaboration goals, developed assessment rubrics, and prepared project guidelines; the results were submitted to the principal and vice principal for curriculum for approval and evaluation; and the collaborative learning was implemented in class-a process that has run since Design Thinking was first introduced five years ago, coinciding with the COVID-19 pandemic and a school policy shift that encouraged inter-teacher collaborative learning.

Three main challenges were identified. Time constraints: the iterative process of exploration, iteration, and reflection in Design Thinking requires a longer time allocation than conventional learning. Difficulty at the early stages (empathize and define): students tend to want to move directly to a product idea without first deeply understanding the problem, making the role of the empathy map and teacher guidance essential. Readiness of students and teachers: not all students have the same level of independence and confidence, and teachers must adapt from teaching to accompanying/coaching students, alongside more complex challenges of timeline discipline, inter-teacher coordination, and authentic assessment; the management of uneven group dynamics also emerged as an additional challenge, one that, per Ericson et al. (2009), itself trains students' social skills. A teacher who participated in the FGD explained, "The empathize and define stages are still quite difficult and require facilitator guidance, because students tend to jump straight to product development or remain shallow in their empathy-stage analysis. Facilitators therefore need to keep refocusing students on the root of the problem and on formulating a strong problem definition before truly generating and developing their ideas."

Discussion

The implementation of Design Thinking demonstrates the characteristics of student-centered learning aligned with Piagetian constructivism and Kolb's experiential learning theory. Student involvement at every stage represents a concrete form of knowledge construction, while the involvement of real users at the test stage confirms that the resulting solutions genuinely meet user needs (Razzouk & Shute, 2012; Syaflita et al., 2024). Design Thinking-based entrepreneurship learning at SMA XYZ aligns with the principles of experiential learning: students do not merely receive theory but practice building a business directly through the annual Entrepreneurship Week. This finding is consistent with (Woraphiphat & Roopsuwankun, 2023), who found that the Design Thinking model increases learning satisfaction and interest in entrepreneurship. The experiential learning cycle-concrete experience, reflective observation, abstract conceptualization, active experimentation-is realized in students' project activities; Design Thinking operationalizes experiential learning principles by positioning students as active subjects in a cycle of action and reflection (Rana et al., 2025), while simultaneously connecting academic theory to students' lived reality (meaningful learning), which in turn builds cognitive resilience.

The 4C findings align with the Partnership for 21st Century Skills framework (Skills, 2009). Four interrelated factors support successful implementation, consistent with (Fullan et al., 2018), who argue that deep learning requires strong school leadership and a collaborative culture, together with a culture of collaboration rather than competition, the teacher's facilitator role, and authentic contextual learning experiences through Entrepreneurship Week that alumni report remain relevant into higher education and work. Notably, the challenges identified in this study appear to become part of the learning process itself: experiences of time constraints, group conflict, and prototype failure push students to adapt and build resilience, consistent with experiential learning theory (Kolb, 2014). Overall, findings at SMA XYZ are firmly rooted in the classic theoretical frameworks of constructivism (Kolb, 2014; Piaget & Inhelder, 2008; Vygotsky, 1978) experiential learning, and are reinforced by recent research on Design Thinking and deep learning. Mean survey scores of 4.3-4.7 across almost all indicators, together with coherent qualitative data from interviews, the FGD, and observations, suggest that the Design Thinking model is not merely a technical teaching method but builds a learning ecosystem that fosters reflective thinking, social empathy, and sustained readiness to face the real world, from senior high school through life after graduation as university students or

entrepreneurs. This study has two main limitations: first, a relatively limited research period; and second, it has not yet evaluated the integration of the Design Thinking model with learning technology, such as artificial intelligence.

CONCLUSIONS

Based on the findings and discussion, Design Thinking-based entrepreneurship learning at SMA XYZ South Tangerang was implemented systematically through the empathize, define, ideate, prototype, and test stages, integrated across intracurricular and cocurricular activities through Entrepreneurship Week. The implementation fostered deep learning through mindful, meaningful, and joyful learning, reflected in scores of 92%, 88%, and 87%, respectively. It also strengthened students' 21st-century skills, particularly collaboration (94%), creativity (92%), communication (90%), and critical thinking (90%). Successful implementation was supported by curriculum integration, collaborative culture, teachers' roles as facilitators, cross-subject learning, project-based activities, and school management support. However, challenges included time constraints, process complexity, students' readiness for in-depth analysis, teacher coordination, and authentic assessment. Despite these challenges, the learning experience contributed to students' personal development and alumni readiness for higher education and the workplace. Overall, Design Thinking provides an effective model for integrating entrepreneurship education, deep learning, and 21st-century competencies. Schools should sustain cross-subject and project-based activities, while future research should examine AI integration and the long-term impact of Design Thinking implementation.

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