Research Article

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Business Incubation Platform to Increase Student Motivation in Creative Products and Entrepreneurship Courses in Vocational High Schools

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Abstract: Entrepreneurship is crucial for economic and social advancement, necessitating the provision of entrepreneurial skills to younger generations. In Indonesia, vocational high schools incorporate entrepreneurship education via Creative Projects and Entrepreneurship (CPE) courses. However, conventional teaching techniques frequently do not adequately develop business competencies. Numerous student-generated goods exhibit deficiencies in strategic branding, commercial alignment, and market relevance, constraining their potential for practical application. This study presents INCUBE, a web-based business incubation platform to improve students' passion for learning and preparedness for entrepreneurship. The platform utilizes design thinking as its pedagogical framework, directing students through systematic incubation phases, encompassing problem identification, business modeling, prototyping, and product presentation. The study used a quasi-experimental methodology, including Alpha Testing, Beta Testing, and Learning Motivation Assessment. Statistical evaluations, comprising paired-sample *t*-tests and N-Gain score computations, evaluate the platform's efficacy in enhancing student engagement and learning outcomes. The findings demonstrate that INCUBE markedly enhances student motivation, evidenced by an N-Gain score of 0.46 (indicating moderate efficacy) and a validated media feasibility rating of 88%. These findings underscore the capacity of web-based company incubation to connect entrepreneurial theory with practice, providing a systematic, technology-oriented method for vocational education.

Keywords: entrepreneurship, learning motivation, web-based learning, business incubation, vocational education

1 Introduction

Entrepreneurship is a vital catalyst for economic expansion and innovation; nevertheless, numerous educational systems inadequately foster entrepreneurial abilities in students. In Indonesia, Vocational High Schools (SMK) seek to incorporate entrepreneurial education via Creative Projects and Entrepreneurship (CPE) courses (Hariyanto, 2023), offering students a foundation to cultivate new company concepts. Observations in several SMKs in Malang (Bahri, Farihah, Ampera, Damanik, & Erni, 2024; Herlambang, Rachmadi, & Wijoyo, 2023; Pamungkas, Rahayuningtyas, & Sayekti, 2024; Suhartadi et al., 2024), Indonesia, indicate that the CPE curriculum is not yielding optimal results. The applied learning approach is traditional, missing a systematic emphasis on product conception and practical business modelling. Consequently, 64.1% of student-generated goods are misaligned with their academic curricula (Wang et al., 2024), and 17% have never developed a product from the CPE course (Mutibwa, 2022). This imbalance constrains students' entrepreneurial readiness and diminishes the efficacy of the vocational education system in cultivating business-oriented mindsets.

Business incubation platforms have developed as a viable approach to overcome these issues in entrepreneurship education (Ravichandran & Dixit, 2024). Business incubators offer organized mentorship, resources, and systematic

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product and business development assistance (Hassan, 2024). The 1000 Digital Startups program, initiated by the Indonesian Ministry of Communication and Informatics (Kominfo), is a significant endeavour that promotes digital entrepreneurship by assisting young entrepreneurs in establishing sustainable economic enterprises (Wibowo et al., 2024). Furthermore, design thinking and online learning have been progressively employed in contemporary entrepreneurial education, providing dynamic, learner-centred educational experiences. Research has shown that combining online business incubators with organized learning frameworks can improve students' motivation, engagement, and practical business competencies (Aithal & Aithal, 2024; Jones, Meckel, & Taylor, 2021; Man, Berger, & Rachamim, 2024). Nonetheless, current incubation methods are predominantly tailored for seasoned entrepreneurs rather than being modified to meet vocational education requirements.

Notwithstanding the established advantages of business incubators, there exists an absence of a systematic incubation model specifically designed for vocational high school students that corresponds with their curriculum and learning preferences (Kabelele, Banele, & Gomera, 2023). Contemporary CPE learning methodologies fail to integrate digital incubation frameworks, resulting in a disparity between students' competencies and entrepreneurial outcomes (Huyler, McGill, & Rocco, 2024). Moreover, current digital incubation programs typically emphasize established firms, creating a significant deficiency in foundational entrepreneurial education (Kaggwa et al., 2024). Incorporating web-based incubation platforms tailored to enhance the CPE curriculum is an inadequately examined domain, warranting additional research and development.

This study presents INCUBE, a web-based business incubation tool for vocational high school students pursuing CPE disciplines. In contrast to current startup incubators, INCUBE is designed to integrate with the vocational education system, featuring a systematic six-stage incubation process: (1) Product Abstract, (2) Team Formation, (3) Business Model Development, (4) Logo and Prototype Creation, (5) Product Publication, and (6) Product Presentation. The platform employs design thinking to assist students in methodically cultivating their company concepts and maintaining coherence with their academic curricula. The primary objective of this research is to assess the efficacy of INCUBE in augmenting students' learning motivation and entrepreneurial preparedness.

This study enhances entrepreneurship instruction in vocational high schools by creating INCUBE. This systematic web-based company incubation platform corresponds with the CPE curriculum. By merging design thinking with company incubation ideas, INCUBE connects vocational education to practical entrepreneurship, providing students with a structured, interactive learning experience. In contrast to conventional CPE learning methods, which are devoid of organized product creation procedures, INCUBE offers a six-stage incubation model that methodically cultivates students' entrepreneurial competencies. This platform improves student motivation, engagement, and competency alignment, providing them with the practical skills to create and market creative goods. Additionally, INCUBE provides a scalable digital solution suitable for widespread implementation in vocational schools, cultivating a new generation of technologically adept entrepreneurs and advancing Indonesia's overarching economic and innovation objectives.

2 Theoretical Background

2.1 Motivation To Learn

Learning is a dynamic and diverse process involving the interaction of various critical components, including educators, learners, instructional materials, pedagogical models, evaluations, and the overarching educational environment (Adeoye, Prastikawati, & Abimbowo, 2024). Each component is essential in determining the efficacy of schooling. Learning encompasses not just the acquisition of knowledge but also the engagement with one's environment, adaptation, and evolution based on experiences and interactions with various stimuli. In this process, students serve as the principal executors, implementing concepts acquired in structured and unstructured settings. Learning efficacy is affected by various elements that either promote or obstruct advancement.

Among these characteristics, motivation emerges as a vital driver of learning achievement (Luria, Shalom, & Levy, 2021). Motivation drives students' excitement, perseverance, and cognitive involvement, eventually influencing their academic achievement. Without motivation, learning may devolve into a passive endeavor, resulting in disengagement and diminished knowledge retention. Studies repeatedly demonstrate that motivated students display elevated curiosity, creativity, and problem-solving skills, enhancing learning results. A deficiency in motivation frequently leads to diminished academic performance, less engagement, and a waning interest in the subject matter.

Numerous theoretical models have been established to augment student motivation, providing educators with

insights to create more interesting and effective learning experiences. The Attention, Relevance, Confidence, and Satisfaction (ARCS) model is a prominent paradigm that systematically enhances and maintains learners' motivation. The ARCS paradigm, created by John Keller, emphasizes four fundamental factors: Engaging students' interest and sustaining involvement through interactive experiences (Chang, 2021). Ensuring that educational content is relevant and applicable, assisting students in developing self-efficacy by facilitating incremental mastery of concepts and reinforcing learning through affirmative feedback and practical applications.

In addition to the ARCS model, various theories have enhanced the comprehension of learning motivation, notably McClelland's Needs Theory, which highlights achievement, power, and affiliation as key motivators (Dostert & Müller, 2021). Goal-setting theory emphasizes establishing distinct, difficult, and achievable objectives to enhance motivation and performance (Latham, 2023). In contrast, Cognitive Evaluation Theory examines the influence of intrinsic and extrinsic motivation on learning behavior (Hsu, 2022). The ARIAS Motivational Model Theory emphasizes autonomy, relatedness, and competence (Gil-Arias et al., 2021). In contrast, the ARSC Motivational Capital Theory builds upon the ARCS model by integrating social and contextual factors affecting motivation (Ma & Lee, 2021).

Motivation has become increasingly essential in the digital and distance education age. Without instructors and peer contact, students in online education frequently have difficulties with engagement and self-discipline. The ARSC model has been recognized as an effective framework for evaluating and enhancing motivation in interactive and digital learning contexts (Bozkurt, Nacak, Karakaş, & Çiftçi, 2025). The fundamental elements – engaging students via multimedia and interactive features, aligning educational resources with career objectives, fostering student confidence through personalized learning experiences, and reinforcing knowledge through incentives and practical applications – have demonstrated efficacy in improving engagement in remote education.

Comprehending learning motivation and its diverse theoretical underpinnings is crucial for formulating effective educational tactics. Motivation is the primary catalyst for student engagement, information retention, and academic achievement in traditional classrooms or digital learning environments. By integrating organized motivation models, educators can develop learning experiences that inspire, challenge, and empower students, resulting in improved educational outcomes and enduring learning habits.

2.2 Entrepreneurship

Entrepreneurship is a mentality and procedure that links market opportunities with expertise, allowing individuals to create creative business solutions (Kuratko, Fisher, & Audretsch, 2021). Entrepreneurship is not a solitary concept; it comprises a blend of abilities, attitudes, and strategic decision-making that enable individuals to recognize and exploit economic possibilities. Entrepreneurship fundamentally correlates with personal characteristics, including creativity, resilience, and risk management. The fundamental entrepreneurial attributes encompass a sense of responsibility, judicious risk-taking, unwavering commitment, and the capacity to utilize resources efficiently to create value (Pirhadi, Soleimanof, & Feyzbakhsh, 2023). These characteristics define successful entrepreneurs and impact the design of entrepreneurship education to cultivate such competencies in students.

Recent breakthroughs in educational technology, online learning platforms, and entrepreneurship education have significantly revolutionized entrepreneurship teaching, especially within vocational education. The amalgamation of Artificial Intelligence (AI) with adaptive learning platforms has facilitated personalized education, wherein AI-driven tutors, such as those on platforms like Khanmigo (Alomair, 2024), offer tailored learning experiences, enhancing student engagement and understanding of business principles.

The global EdTech business has grown swiftly, with forecasts predicting it would attain $404 billion by 2025 (Nichols & Dixon-Román, 2024). This expansion underscores the growing dependence on digital platforms and technology-enhanced educational solutions, rendering entrepreneurship education more accessible and efficient. Moreover, experiential learning approaches, such as corporate simulations and gamification, have become increasingly significant. These technologies facilitate students' engagement in authentic business settings, enhancing their problem-solving and strategic decision-making abilities. Moreover, unconventional educational platforms like TikTok and YouTube have surfaced as prevalent channels for entrepreneurial instruction, offering captivating, easily digestible content that improves learning adaptability (Nguyen & Diederich, 2023).

The function of business incubators has transformed considerably in aiding startups and entrepreneurial endeavors. Contemporary incubators offer organized coaching, investment opportunities, and collaborative environments, allowing nascent enterprises to enhance their models and scale efficiently. Research demonstrates that incubators play a crucial role in fostering startup success, especially in economies characterized by robust digital innovation ecosystems (Cavallo, Ghezzi, & Rossi-Lamastra, 2021;

Gumbo & Moos, 2024; Silvestro, de Matos, da Silva, dos Santos Reis, & Teixeira, 2024).

Business incubation methods are progressively being incorporated into the curricula of universities and vocational schools. Institutions are creating incubators as training environments, enabling students to implement theoretical knowledge in practical contexts. This method connects academic education with industry requirements, providing students with practical experience in product development, business modeling, and market strategy. These projects promote creativity, improve entrepreneurial abilities, and offer a systematic route for students to go from education to business ownership.

Incorporating digital learning, AI-enhanced education, and company incubation models directly impacts the instruction and application of entrepreneurship in vocational high schools. The suggested INCUBE company incubation platform conforms to contemporary methodologies by providing students with a systematic, technology-enhanced entrepreneurial education. By rectifying existing deficiencies in entrepreneurship education, INCUBE offers a pragmatic solution that improves student engagement, cultivates practical business acumen, and facilitates the development of future entrepreneurs within the digital economy.

2.3 Business Incubation

An evolution is being incubated. In the field of medicine, incubation refers to the development of a disease symptom or growth in an infant. Incubation, on the other hand, is described in the business sector by Hewick from the Canadian Business Incubator as the process of fostering competent entrepreneurs in a workspace run by an institution (Yuslem, Nawawi, & Dahrul, 2022). A business incubator, on the other hand, is defined as a nurturing facility or a hatchery for aspiring entrepreneurs, particularly in a business sense (Rafiana, 2023). So, an organization that fosters the development of businesses is known as a business incubator.

Business incubators are often referred to as the name of an office or place. However, since the popularity of StartUp development, business incubators are no longer just a building for consultation between mentors and incubation participants (Clayton, 2024). Instead, it can be a competition and a platform. In Indonesia, there have been many incubator and business accelerator programs online and offline, in an effort to give birth to many new entrepreneurs (Habiburrahman et al., 2022). There are several popular business incubator programs in Indonesia, such as 1001Startup, The Next Dev, Mikti, Edeavor, Indigo, and many more. The large number of business incubator programs indicates that business incubators are an effective solution for the development of the creative economy in Indonesia (Anjaningrum, Sidi, Yogatama, Hermawati, & Suci, 2023). In line with Adibah's opinion, that business incubators are a tool that is widely used by developing countries including Indonesia, as a means of developing new businesses and small and medium enterprises (SMEs) (Surbakti & Nurzaman, 2025). The Indonesian government has also shown its support for the business incubator program through Presidential Regulation no. 27 of 2013 concerning Development of Entrepreneurial Incubators.

2.4 Web Based Learning

Web-based learning is an example of a platform that requires a browser in order to function at all (Anwyl-Irvine, Dalmaijer, Hodges, & Evershed, 2021). The web is a collection of websites connected by connections and containing various types of information in the form of images, text, or sound (Ida Ayu Sutarini, Safitri, Maulida, & Putra, 2024). One of the factors promoting the growth of distance learning is the use of the internet as a learning tool. In a number of European nations in the middle of the 1800s, distance learning started to gain international recognition (Rubayet & Imam, 2021). The efficacy of teaching and learning activities is the sole goal of employing web technology as a learning medium. Web-based learning is the term typically used to describe the use of the internet as a learning tool (Mehrolia, Alagarsamy, & Indhu Sabari, 2021). Because all forms of learning, including discussion boards through email, video conferencing, and live streaming learning, can be done online. Web-based learning is also sometimes referred to as online learning or E-learning (Ubaydullaeva et al., 2024).

There are many advantages for teachers and students in using the web as a learning medium. Some of the advantages include efficiency in delivering learning materials and materials, learning materials can be accessed anywhere and anytime, learning links can be made into various formats, and access to learning has the potential to be developed (Anyim, 2021). Several differences between traditional learning and web-based learning are shown in Table 1.

2.5 Design Thinking

Design thinking is a development model that uses an innovative approach considering several factors such as

Table 1: Comparison of traditional and web-based learning

Traditional learning	Web-based learning
Teacher-centered instruction	Student-centered instruction
Single-path stimulation	Multisensory stimulation
Single media	Multimedia
Isolated work	Collaborative work
Information delivery	Information exchange
Passive learning	Active learning
Knowledge-based learning	Critical thinking
Artificial context	Real world context

humans, business, and technology (Bartoloni et al., 2022). Design thinking was developed by the Hasso-Plattner-Institue (HPI) in Potsdam, Germany. Design thinking is a learning approach that focuses on solving problems, investigating solutions, creating prototypes, collaboration, and reflection (Verganti, Dell'Era, & Swan, 2021). Design thinking contains an iterative process. It is an iterative process because it involves understanding the user, challenging assumptions, defining the problem, and identifying strategies and solutions, which may not be obtained with the initial understanding, so they must be repeated. Several stages must be passed when developing media using design thinking, including (1) Emphasize, (2) Define, (3) Ideate, (4) Prototype, and (5) Test (Verganti et al., 2021) (Figure 1).

This study's theoretical framework integrates entrepreneurship education, online learning, company incubation, and design thinking to enhance student learning and motivation in vocational education. These parts are interconnected, each facilitating the advancement of a contemporary, efficient pedagogical method for instructing entrepreneurship.

Entrepreneurship education has adapted to the requirements of the digital economy, necessitating that students cultivate both business insight and technological expertise (Yu & Jiang, 2021). Conventional teaching methods frequently neglect to include students in practical business applications, prompting the introduction of innovative pedagogical models like business incubation and online learning. Business incubators offer a systematic environment for cultivating entrepreneurial competencies and assisting students in conceptualizing, designing, and initiating their business ventures. Incubators in educational contexts necessitate excellent instructional strategies to guarantee student engagement and knowledge application, wherein web-based learning is crucial.

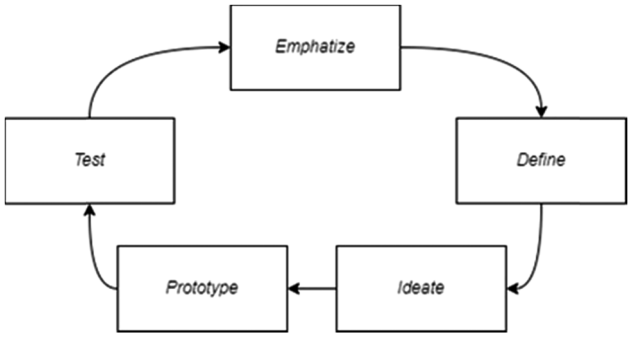

Figure 1: Stages of design thinking.

Web-based learning improves accessibility, interaction, and engagement, making it an invaluable entrepreneurial education resource. In contrast to conventional classroom environments, online platforms offer adaptable, individualized, and technology-enhanced educational experiences. Students can communicate, obtain mentorship, and simulate authentic entrepreneurial processes using web-based incubation platforms such as INCUBE. Research has substantiated the efficacy of web-based learning in entrepreneurship education, highlighting its capacity to augment student involvement, foster critical thinking, and boost information retention.

The Design Thinking approach effectively organizes entrepreneurial learning in a web-based incubation environment. Design Thinking is a problem-solving paradigm that parallels the entrepreneurial process, as both entail problem identification, solution ideation, prototyping, and testing. This study uses Design Thinking as the educational framework to guide students through incubation. The five stages of Design Thinking – Empathize, Define, Ideate, Prototype, and Test – correspond to the business creation phases, rendering it an ideal framework for entrepreneurship education. This study integrates Design Thinking with web-based learning, enabling students to grasp theoretical concepts and apply them in a controlled, iterative process that simulates real-world business development.

Consequently, the relationship between entrepreneurial education, business incubation, online learning, and design thinking constitutes a cohesive pedagogical framework. Business incubation establishes a systematic framework for entrepreneurial education, online platforms improve interaction and accessibility, and Design Thinking presents a process-oriented approach to learning and innovation. Collectively, these elements establish a cohesive, technology-augmented educational structure that equips students for the demands of contemporary entrepreneurship.

3 Method

The selection of Design Thinking as the research methodology is based on its capacity to promote organized,

student-centered learning, following the tenets of web-based education and motivational frameworks such as ARCS (Attention, Relevance, Confidence, and Satisfaction). Design Thinking offers a framework that facilitates problem-solving, creativity, and user-centered development – crucial components in entrepreneurial education. The iterative, practical methodology is especially efficacious for company incubation, wherein students must systematically develop, test, and revise their concepts.

The relationship between Design Thinking and ARCS theory is rooted in their mutual focus on engagement and motivation. The ARCS model posits that student motivation is enhanced when learning is engaging, pertinent, confidence-enhancing, and fulfilling. Design Thinking inherently adheres to these principles:

- Sustained attention is achieved through interactive, real-world problem-solving, necessitating pupils to identify and tackle difficulties through a creative, iterative process.
- Relevance is achieved by aligning entrepreneurial projects with actual market demands, enabling students to develop significant commercial solutions.
- Confidence is created as students advance through the incubation phases, obtaining feedback, refining their concepts, and acquiring practical experience.
- Satisfaction derives from concrete results – students create market-ready items and acquire real business skills that are readily applicable.

Incorporating Design Thinking into online learning is crucial, as digital platforms provide enhanced accessibility, collaboration, and immediate feedback – elements that improve the iterative process of Design Thinking. In contrast to in-person learning, which depends on physical encounters and instructor-led sessions, online Design Thinking facilitates ongoing participation through digital collaboration tools, discussion forums, virtual prototyping platforms, and digital business simulations. Web-based learning facilitates self-paced discovery, essential in entrepreneurial education, as students generate ideas at varying rates and necessitate access to a wide array of resources.

Applying Design Thinking online necessitates meticulous organization to sustain engagement and efficacy. The six incubation processes of the INCUBE incubation platform correspond to the five phases of Design Thinking as follows:

1. Empathize → Product Abstract: Students recognize market challenges and delineate business prospects.
2. Define → Team Formation & Business Model: They delineate roles, duties, and systematic business planning.
3. Ideate → Logo and Prototype: Students generate and develop preliminary business concepts encompassing branding and digital identity.
4. Prototype to Product Publication: The product is developed and marketed digitally, emulating an authentic business.
5. Evaluation → Product Presentation: Students present their concepts, obtain mentorship and feedback, and refine their ideas depending on the replies received.

The systematic incorporation of incubation phases into the design thinking framework guarantees that students will encounter authentic entrepreneurial issues within a controlled, iterative learning cycle. Using a web-based incubation platform, students may cultivate their ideas, collaborate remotely, test prototypes, and dynamically and interactively enhance their business models.

This research used Design Thinking as the primary instructional framework due to its alignment with ARCS motivational concepts, its capacity to promote web-based learning engagement, and its provision of a systematic method for digital company incubation. This concept diverges from conventional lecture-based entrepreneurship courses by requiring students to actively engage in business development through iterative experimentation and practical application, enhancing the learning experience's impact, engagement, and relevance to the industry.

In the procedure for using the Design Thinking model, 5 steps must be carried out in developing the desired media. The procedure for developing a business incubation platform for creative and entrepreneurship project subjects is as follows:

3.1 Emphasize

In this stage, observations are carried out on the target users who will be the subject of application trials, namely, vocational students. The observation stage spread initial observations across 3 vocational schools, namely SMKN 1 Purwosari Pasuruan, SMKN 4 Malang, and SMKN 6 Malang. Based on the results of initial observations that the researcher carried out by distributing questionnaires and interviews with several students with Software Engineering (RPL) competency skills and several teachers in Creative Project and Entrepreneurship (CPE) subjects at Vocational High Schools, the following information was obtained:

(1) As many as 82.1% of students in the list of respondents operate their smartphones for more than 4 h a day, and 66.7% have adequate internet access.
(2) Most of the products produced by students from creative projects and entrepreneurship subjects are conventional and non-linear products with RPL expertise.

The observation data found that 64.1% of all respondents produced products such as processed food, drinks, crafts, and conventional buying and selling businesses.

(3) Students' interest in learning creative projects and entrepreneurship subjects is high.
(4) Learning based on product development is rarely carried out. Hence, the products students produce lack innovation and have minimal supporting outcomes.
(5) Students do not know enough about business incubation activities.

3.2 Define

From the previous stage, namely Emphatize, some data on habits, infrastructure, and motivation from students were obtained. In the Define stage, researchers must summarize some of this data into user needs data as material for designing learning media products. Several needs can be concluded, as follows:

(1) Supported by students using gadgets for quite a long time, electronic learning media that utilizes the gadgets owned by students is needed.
(2) A new learning system is needed to help balance the skills of RPL students with the products produced in Creative and Entrepreneurship Project (CPE) subjects.
(3) Conditioning efforts are needed so that CPE learning carried out by students and supporting teachers can produce a product full of innovations.
(4) There needs to be an introduction and application of business incubation in teaching and learning activities.

3.3 Ideate

From the results of observations that have been defined as data on user needs, solutions are provided that are able to answer user needs at this stage. Based on the needs that have been defined, the researcher provides a solution in the form of developing learning media with the concept of business incubation, which is applied to support creative and entrepreneurial project learning in Vocational High Schools. A business incubation platform (business incubator) is a medium for maturing business ideas and equipment. Following the problems obtained, the developed business incubator is focused on incubating business ideas engaged in digital industries such as e-commerce, software houses, smart homes, the game industry, and the like. The media is designed to run on the website platform to suit the habits of students who use much time operating smartphones and laptops. In this stage, the incubation stage in learning media is also defined into 6 steps as follows:

(1) Product Abstract: This is the step in formulating initial business ideas and products that will be designed in abstract form.
(2) Team Formation: In this step, students form a team (study group) of 3 people. From this team, tasks must be divided according to the net. As for the division of tasks themselves, they are divided into 3 roles that are commonly used in startups, namely Hustler (team leader), Hipster (responsible for design and publication), and Hacker (responsible for technology).
(3) Business Model: students carry out a detailed design of the concept and business model that will be built using the Business Model Canvas format. In this stage, the team (study group) again details the business idea, which was originally an abstract form, converted into a 9-point Business Model Canvas. The nine points of the Business Model Canvas, namely (1) Consumer Segmentation, (2) Consumer Value Proposition, (3) Channels, (4) Sources of Income, (5) Resources, (6) Consumer Relations, (7) Activities carried out, and (8) Cooperation.
(4) Logo and Prototype: After forming the business model, each group must formulate a logo and make a prototyping design for their respective products. So, this stage is also the initial effort in the product branding process.
(5) Product Publication: in this step, each group must make a poster containing product information and a product video as output to support the publication of the business and product being designed.
(6) Product Presentation: In the final stage of incubation, students must make a presentation file (pitch deck) to introduce the product directly through presentations.

3.4 Prototype

Prototype is the fourth stage of Design Thinking. At this stage, the idea formulated in the previous stage is implemented into a usage scenario for an application or trial product.

3.5 Test

The trials in this study were divided into three types: Alpha Testing, Beta Testing, and Learning Motivation Testing.

Table 2: Trial stages and subjects

No	Trial type		Test subjects	Number of subjects
1	Alpha testing	Material expert test	Materials expert	1
		Media expert test	Media expert	
2	Beta testing	User due diligence test	Class XI RPL students at SMKN 1 Purwosari	30
3	Learning motivation test	Motivation test before using media (pretest)	Class XI students at SMKN 1 Purwosari	30
		Motivation test after using media (postest)		

Alpha testing is media testing that is assessed from the developer's point of view, and expert judgment experts carried out the test (Wien & Jung, 2024). In this study, Alpha Testing was divided into media feasibility tests by media experts and material feasibility tests by material experts. Validation by media experts was carried out to obtain media feasibility data. The indicators that media experts will assess are in Table 3. After that, material experts validate the material presented in the media to obtain data on the suitability of the material with the learning objectives of the elements taken. The indicators that material experts will assess are in Table 2.

Meanwhile, Beta Testing tests media and material aspects carried out by target users, namely students. The final test is a motivation test carried out to know students' motivation and interest in the subject after using the media.

The development and evaluation of the INCUBE business incubation platform followed a structured research methodology using the Design Thinking model, which consists of five key stages: Empathize, Define, Ideate, Prototype, and Test. The testing phase involved three levels of evaluation: Alpha Testing, Beta Testing, and Learning Motivation Testing.

In Alpha Testing, experts in instructional media and subject matter evaluated the platform's feasibility. The evaluation criteria included usefulness, ease of use, learning, and user satisfaction. The validation process involved calculating the mean rating for each category and determining the percentage of agreement among experts.

Beta Testing was conducted with vocational high school students to assess the platform's usability, effectiveness, and engagement level. A pretest–posttest design was implemented, where students were assessed on their entrepreneurial learning outcomes before and after using INCUBE. The sample size for this phase was determined using Cohen's power analysis to ensure adequate statistical power (0.80) at an alpha level of 0.05, ensuring that the study could detect meaningful differences between pretest and posttest scores.

For the Learning Motivation Testing, the study employed a quasi-experimental design with a paired-sample *t*-test to measure the significance of changes in students' motivation levels before and after using INCUBE. The key statistical tests used in the study are detailed below:

1. Descriptive Statistics:
   - Mean, standard deviation, and percentage scores were computed for each test phase to summarize participant responses and expert evaluations.
   - Data normality was tested using the Kolmogorov–Smirnov test, ensuring the normality assumption was met before applying parametric tests.
2. Paired-Sample *t*-Test:
   - Used to compare pretest and posttest motivation scores, testing whether the observed changes were statistically significant.
   - Assumptions:
     - The difference scores should be normally distributed (tested via Shapiro–Wilk).
     - The samples should be related (paired data from the same students).
   - Effect sizes (Cohen's *d*) were computed to measure the magnitude of the effect, with interpretations as follows:
     - $d = 0.2$ (small effect);
     - $d = 0.5$ (moderate effect); and
     - $d = 0.8$ (large effect).
3. N-Gain Score Analysis:

Table 3: Media validation indicator

No	Indicator	Item number	Description
1	Usefulness	1, 2, 3, 4, 5, 6, 7, 8	The use of effective applications in the learning carried out
2	Ease of use	9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	The application provides an easy and useful interface for learning
3	Ease of learning	20, 21, 22, 23	Ease of application to learn and remember the flow of use
4	Satisfaction	24, 25, 26, 27, 28, 29, 30	The application used gives a sense of satisfaction in learning

- Used to determine the effectiveness of INCUBE in improving student motivation.
- Formula:

N-Gain = Posttest Score−Pretest Score Maximum Score−Pretest Score

N\text{−} Gain = \frac{\text{Posttest Score} − \text{Pretest Score}}{\text{Maximum Score} − \text{Pretest Score}}

N-Gain = Maximum Score−Pretest Score Posttest Score−Pretest Score

- Interpretation of N-Gain values:
  - o $g \geq 0.70$: High effectiveness;
  - o $0.30 \leq g < 0.70$: Moderate effectiveness; and
  - o $g < 0.30$: Low effectiveness.

4. Confidence Intervals and *p*-Values:
   - 95% Confidence intervals (CI) were calculated to provide a range within which the true effect likely falls, increasing the reliability of the findings.
   - *p*-Values were reported for all statistical tests, with $p < 0.05$ indicating statistical significance. This ensures that the improvements observed were unlikely to have occurred by chance.

Cronbach's alpha was used to assess the internal consistency of the survey instruments to ensure the reliability of the study. A threshold of $\alpha > 0.70$ was considered acceptable. In terms of validity, the study used content validation by expert judges and construct validation via factor analysis to confirm that the motivation assessment tool measured what it intended to.

This rigorous statistical approach, including paired-sample *t*-tests, effect size calculations, N-Gain analysis, confidence intervals, and *p*-values, ensures that the findings on the impact of INCUBE on student motivation and learning are robust and reliable. By clearly detailing the statistical methods used, this section enhances the transparency and replicability of the research.

The INCUBE business incubation platform was evaluated through a series of structured tests, each assessing different aspects of its feasibility, usability, and effectiveness. The results from these evaluations are summarized in Tables 2–4, which provide insights into the quality and impact of INCUBE as an educational tool.

Table 2 outlines the three levels of testing used to validate INCUBE: Alpha Testing, Beta Testing, and Learning Motivation Testing. Alpha Testing involved media and subject matter experts assessing the platform's content and technical feasibility. Beta Testing focused on student usability and was conducted with vocational high school students enrolled in the Creative Projects and Entrepreneurship (CPE) course. Finally, Learning Motivation Testing measured changes in student motivation before and after using INCUBE. The number of participants in each phase was carefully determined to meet statistical power requirements, ensuring the reliability of the findings.

Table 3 presents the evaluation criteria used in Alpha Testing to assess the platform's usability and effectiveness. Four key indicators were measured: usefulness, ease of use, ease of learning, and user satisfaction. Each indicator was assigned a set of assessment items, which experts rated based on predefined usability standards. The results showed that INCUBE received high validation scores across all indicators, confirming the platform's well-designed and functional.

Table 4 details the evaluation metrics used to assess the quality of learning content provided in INCUBE. Three primary indicators were examined: learning design, content material, and language and communication. Learning design focuses on the clarity of objectives and alignment with course requirements. Content material evaluated the depth and relevance of the instructional content, and language and communication assessed readability and instructional clarity. The results indicated that INCUBE met high content validity standards, with minor revisions suggested for enhancement.

The evaluation confirmed that INCUBE is a valid and effective learning tool for vocational high school students in entrepreneurship education. The structured testing approach, including Alpha Testing, Beta Testing, and Learning Motivation Testing, provided comprehensive insights into its usability, content relevance, and impact on student motivation.

By employing statistical analyses, including paired-sample *t*-tests, N-Gain calculations, effect size

Table 4: Material validation indicator

No	Indicator	Description	Item number
1	Learning design	Clarity of learning objectives and relevance of learning aspects	1, 2, 3, 4
2	Content material	Continuity, quality, topicality, scope and depth of material	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
3	Language and communication	Correctness of language, suitability of language style, and accuracy of learning editorial	17, 18, 19, 20

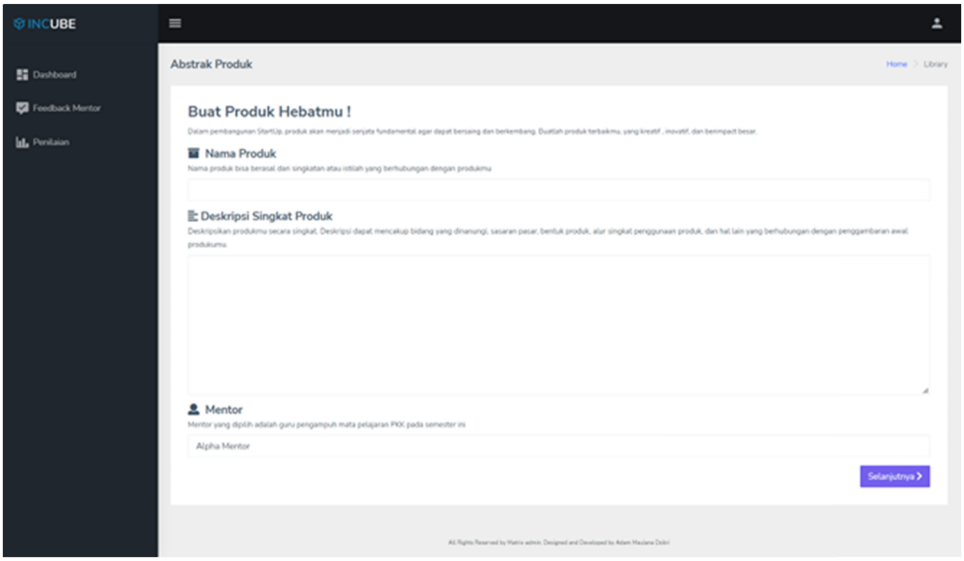

Figure 2: Product abstract stages.

measurements, and confidence interval assessments, the study ensured objective validation of INCUBE's effectiveness. The results demonstrated that students who used INCUBE significantly improved learning motivation and engagement, supporting the platform's potential for broader implementation in vocational education.

These findings underscore the importance of integrating business incubation models into entrepreneurship education, particularly through digital platforms like INCUBE. By aligning instructional strategies with modern digital learning methodologies, this research advances innovative, student-centered educational approaches that prepare students for the digital economy's demands.

4 Results and Discussion

From a series of observation activities for students, defining problems and needs, and designing learning

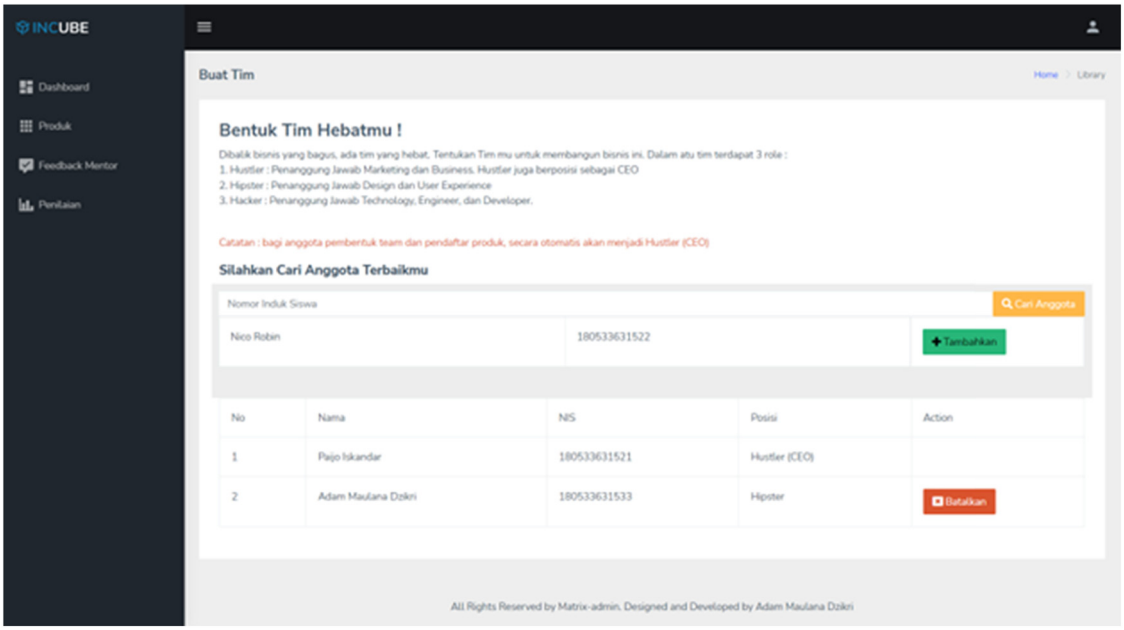

Figure 3: Stages of team formation.

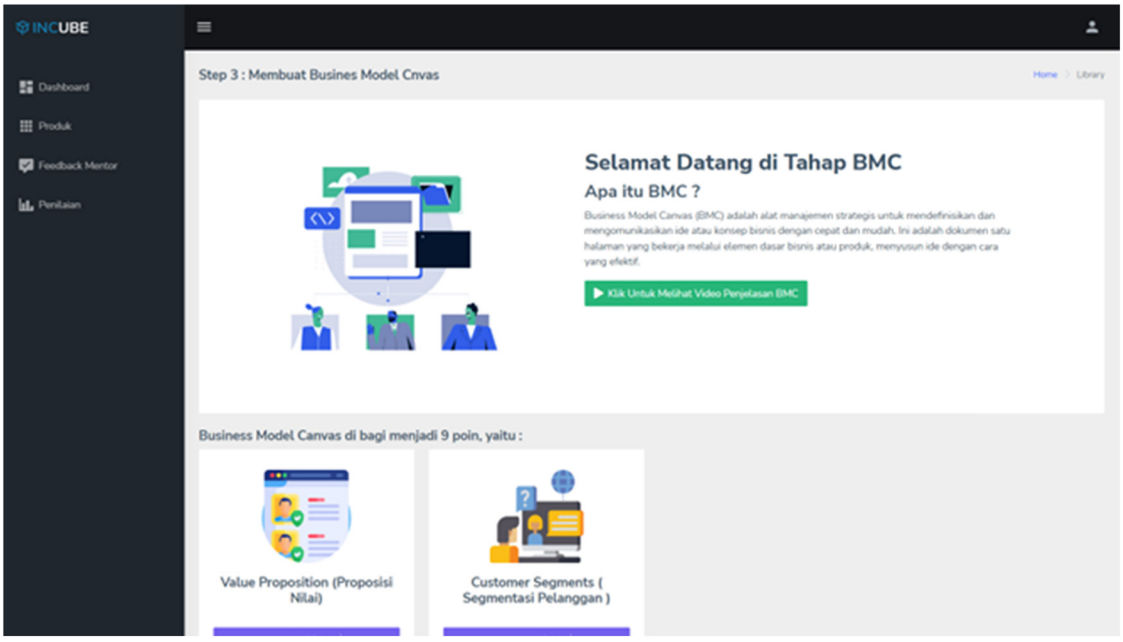

Figure 4: Business model stages.

media, the learning media was created with the name INCUBE. The INCUBE learning media is a web-based application (Web Application) that was developed to serve as a supporting medium in teaching and learning activities for Creative Projects and Entrepreneurship (CPE) subjects in Vocational High Schools with the concept of online business incubation (Iliadis et al., 2025). Following its objectives, the material presented in this learning media is adapted to the elements and flow of learning objectives from CPE subjects in SMK. In this media, learning is conditioned through business incubation or maturation. Thus, as usual, incubation platforms, mentors, and incubation participants must be involved in the workflow. In INCUBE, students are assigned as team incubation participants,

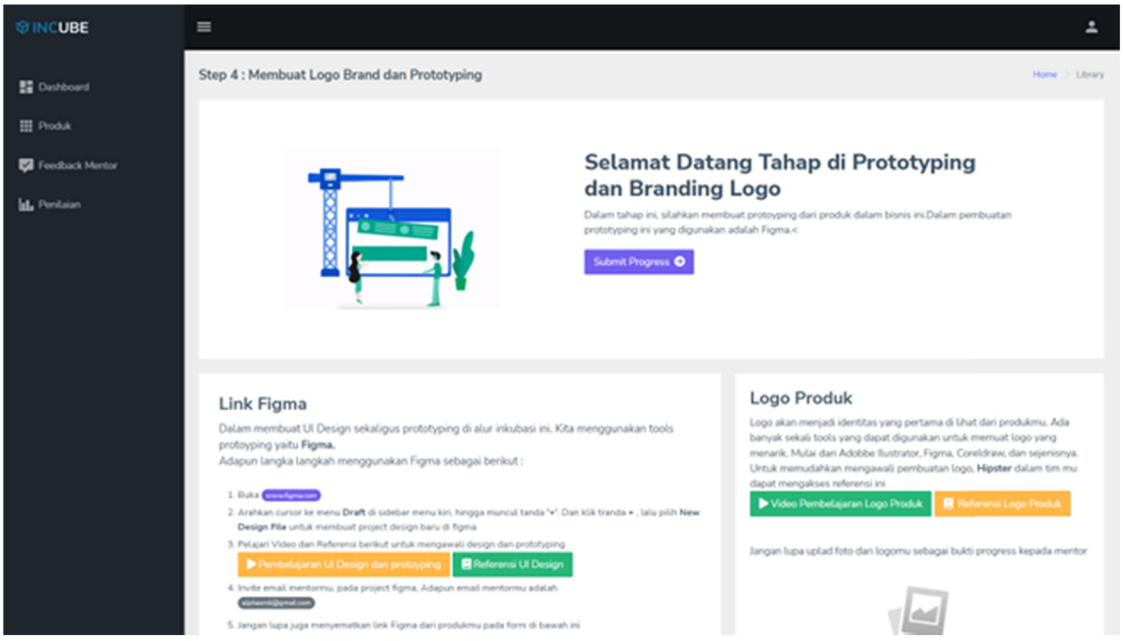

Figure 5: Business model stages.

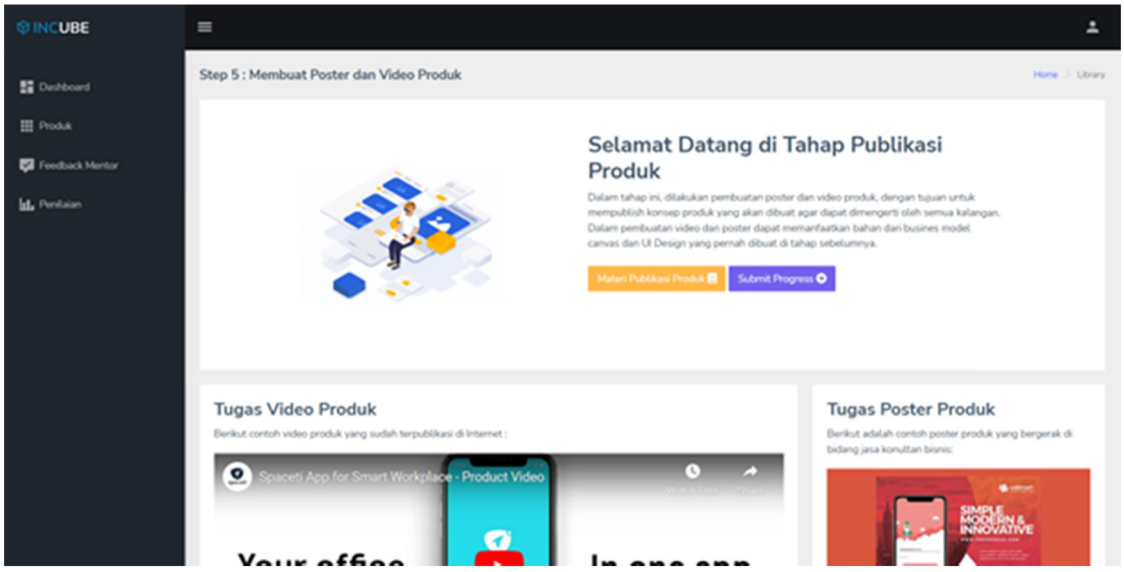

Figure 6: Product publication stages.

while teachers act as mentors who guide each incubation stage. In line with the incubation concept, INCUBE consists of six stages, namely: (1) Product Abstract; (2) Team Formation; (3) Business Model; (4) Logo and Prototype; (5) Product Publication; (6) Product Presentation. Of the six stages of incubation, each study group must go through each stage with the approval and guidance of the teacher who acts as the incubation mentor. The following Figures 2–7 are a display of the 6 stages of the INCUBE application.

The average percentage results from four indicators, namely: (1) Usefulness, (2) Ease Of Us, (3) Ease of Learning, and (4) Satisfaction. The INCUBE application gets a feasibility percentage of 88%. With these percentage results, the INCUBE application falls within the very valid criteria without requiring revision. The graph of material validation data is presented in Figure 8.

The results of the average percentage of the four indicators, namely: (1) Learning Design, (2) Material Content,

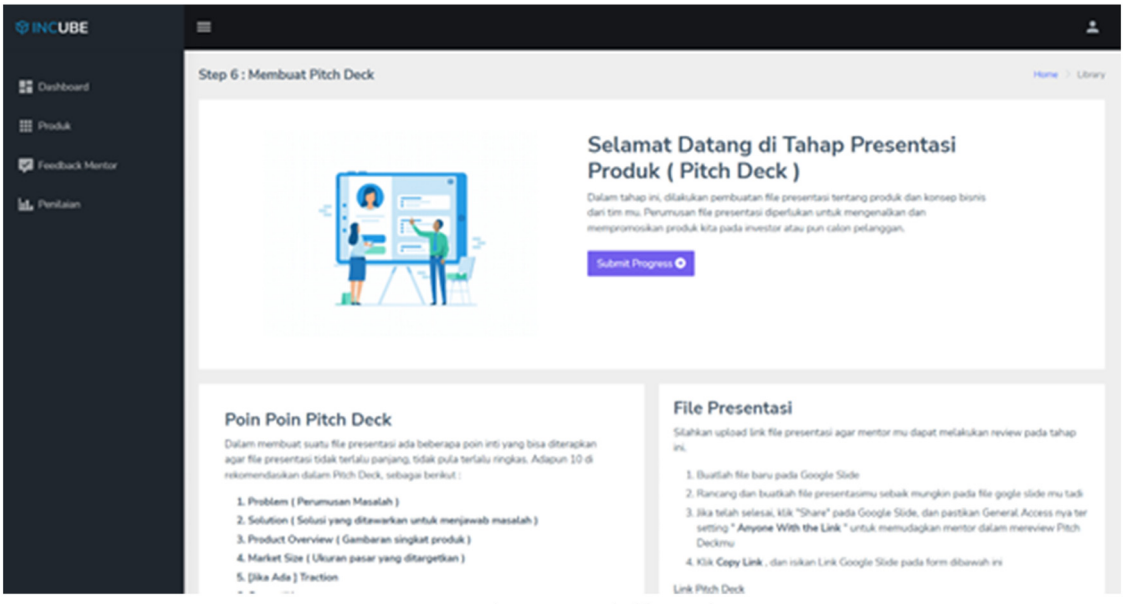

Figure 7: Product publication stages.

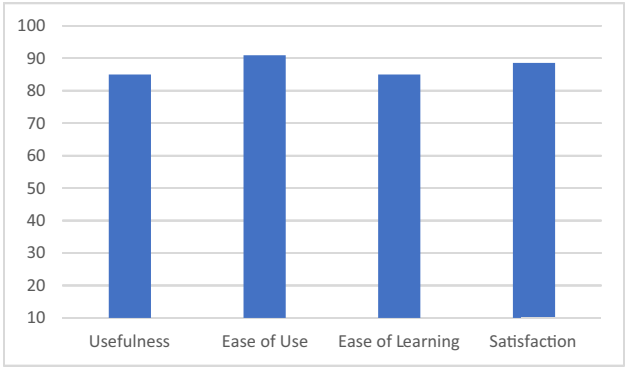

Figure 8: Media expert validation.

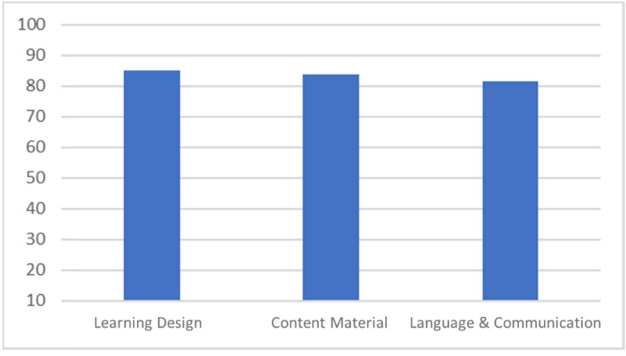

Figure 9: Material expert validation.

and (3) Discussion and Communication, the INCUBE application gets an eligibility percentage of 81.43. With the results of these percentages, the INCUBE application is quite valid and requires a little revision (Figure 9).

User trials on the INCUBE application were conducted at SMKN 1 Purwosari Pasuruan, precisely in class XI, Software Engineering (RPL) competency. The number of users in this trial amounted to 36 students who acted as incubation participants and one CPE teacher as a mentor. The scenario for this application trial begins with the formation of 12 groups, each group containing 3 students. After that, each group is required to conceptualize a business and its products through 6 incubation steps in the INCUBE application. Each incubation step, passed by each group, must go through the approval and evaluation of the mentor. The results of user trials from the media aspect are shown in Table 5, and from the material aspect in Table 6.

Table 5: Media aspect test results

No	Indicator	TSe	TSh	*V*(%)	Criteria
1	Usefulness	436	540	80.74	Fairly valid
2	Ease of use	679	900	75.44	Fairly valid
3	Ease of learning	280	360	77.78	Fairly valid
4	Satisfaction	433	540	80.19	Fairly valid
	TSe	1,828	$V = \frac{\sum TSe}{\sum TSh} \times 100\%$		
	TSh		2,340	78.12	Fairly valid

Table 6: Material aspect test results

No	Indicator	TSe	TSh	*V*(%)	Criteria
1	Learning design	436	540	80.74	Fairly valid
2	Content material	679	900	75.44	Fairly valid
3	Language and communication	280	360	77.78	Fairly valid
	TSe	1,828	$V = \frac{\sum TSe}{\sum TSh} \times 100\%$		
	TSh		2,340	78.12	Fairly valid

The learning motivation test is a stage to determine how much the application or learning media developed can influence students in terms of learning motivation [39]. In this research, students' motivation was tested using a questionnaire instrument containing 21 statements, which had to be assessed by students as users of the INCUBE application. The questionnaire also contains 4 indicators: Attention, Relevance, Confidence, and Satisfaction. Learning motivation testing is carried out twice, namely before students use the application and after using the application. Data on increasing motivation obtained from the pretest and posttest results are presented in Figure 10. N Gain testing was also carried out, and the results obtained are in Table 7 to measure the effectiveness of motivation.

In this floating research, one learning media application product was found as a Web Application called INCUBE. INCUBE is a learning media platform with the concept of business incubation to support teaching and learning activities in creative projects and entrepreneurship subjects in vocational schools (Iliadis et al., 2025). The target users for this application are vocational school students with software engineering skills who are studying Creative Projects and Entrepreneurship subjects. The choice of targets is based on the incubation concept, which, in the application, is specifically for product and business

Table 7: N Gain Test Results

Mean protest	Mean pretest	Mean (post–Pre)	Mean (max–pretest)	G score
84.58	75.50	11.53	29.50	0.46

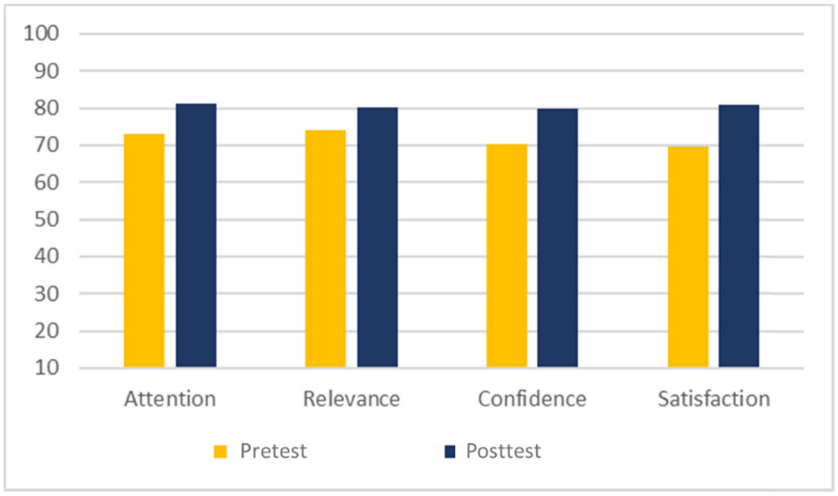

Figure 10: Material validation data graph.

development in the information technology sector. In INCUBE, the material is presented through videos and reasoning case studies.

In the development process, INCUBE was designed and developed using the Design Thinking development model from the Hasso-Plattner-Institue (HPI), where the development procedure is divided into 5 stages, namely: (1) Emphasize; (2) Define; (3) Ideate; (4) Prototypes; (5) Test. According to the stages of the Design Thinking model, the development procedure ends with a test or test. INCUBE is tested in 3 stages, namely Alpha Testing, Beta Testing, and motivational testing. In Alpha Testing, INCUBE is tested by material experts and media experts. As a result of Alpha Testing, INCUBE received a media aspect percentage of 88% and a material aspect percentage of 83%, which indicates that INCUBE is valid and can be tested on users through Beta Testing. In Beta Testing, testing is carried out on target users, namely vocational school students taking Creative Project and Entrepreneurship subjects. This testing process was conducted on class XI SMK students at SMKN 1 Purwosari Pasuruan, totaling 36 RPL competency skills. The results of Beta Testing, INCUBE, get a valid percentage of 80%, indicating that INCUBE is valid enough. The final test is the student motivation test, which is carried out before and after students use the INCUBE learning media. When finished using the INCUBE method, the test results showed that the percentage of student motivation was 80.56%, which is considered strong motivation. The percentage of students' learning motivation before using INCUBE was 71.09%, which is considered strong motivation. In addition, to measure the effectiveness of increasing learning motivation before and after using INCUBE, an N-Gain test was carried out. From the N-Gain test, a gain score of 0.46 was obtained, which is classified as moderate effectiveness. This indicates that INCUBE can increase students' level of learning motivation.

The INCUBE company incubation platform has proven efficient in boosting student enthusiasm and entrepreneurship education. However, specific constraints present chances for further enhancement and refinement. A key drawback of the current study is that INCUBE, as a structured incubation platform, has yet to integrate advanced new technologies, including AI-driven mentoring, gamification, or real-time data analytics.

Subsequent versions of INCUBE may improve student engagement and learning outcomes by including AI-driven mentoring systems that offer individualized assistance, feedback, and adaptive learning routes tailored to individual student progress. Moreover, gamification components designed for vocational education, such as interactive challenges, leaderboards, and reward-driven advancement, could enhance student motivation and engagement. A further domain for further investigation is real-time data analytics, enabling instructors to monitor student performance, evaluate entrepreneurial competencies, and implement data-driven interventions.

Subsequent research should broaden the application of INCUBE across other vocational institutions and heterogeneous student populations to assess its adaptability and scalability. Implementing longitudinal studies to evaluate the enduring effects of web-based company incubation on students' entrepreneurial performance will yield profound insights into its efficacy in cultivating future entrepreneurs. By incorporating these novel features and broadening the study area, INCUBE can persist in advancing as a state-of-the-art educational instrument in entrepreneurship and vocational education.

5 Conclusion

Based on the results of testing media, material, users, and motivation, it can be concluded that INCUBE learning media with the business incubation concept can fulfil the objectives of this research, namely:

(1) Developing learning media as a Web Application for Creative Projects and Entrepreneurship subjects for vocational school students, with the concept of business incubation.
(2) The learning media in the form of a Web Application developed for Creative Projects and Entrepreneurship learning subjects was declared valid and appropriate by media and material experts. The media is also rated as appropriate by the target user. Namely, vocational students are currently taking Creative Projects and Entrepreneurship subjects.
(3) The learning media, as a Web Application developed, can increase students' learning motivation in Creative Projects and Entrepreneurship subjects.

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