JURNAL ILMIAH MANAJEMEN BISNIS DAN INOVASI UNIVERSITAS SAM RATULANGI (JMBI UNSRAT)

A DESIGN THINKING-BASED DEVELOPMENT OF A WEB APPLICATION INTERFACE FOR STUDENT STARTUP PLANNING AT POLITEKNIK HASNUR

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ARTICLE INFO

Keyword: *Design Thinking, UI/UX Design, Web-Based Application, Student Startup*

Kata Kunci: Design Thinking, UI/UX Design, Aplikasi Berbasis Web, Startup Mahasiswa

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Abstract. *This research explores the design of a web-based application to support students at Politeknik Hasnur in planning startups, using the Design Thinking methodology. The study encompasses all five stages—Empathize, Define, Ideate, Prototype, and Test—to comprehensively address user needs and create innovative solutions. Data was collected through surveys, observation, and interviews involving students. Brainstorming, SCAMPER, Six Thinking Hats, heuristic evaluation, and usability testing were incorporated to refine and validate design outcomes. The findings revealed key challenges faced by students, including difficulties in team matching, accessing structured learning materials, and managing startup projects. Proposed features include a keyword-based matching algorithm, a learning hub with progress-tracking checklists, a kanban board for project management, and flexible mentoring systems integrated with external platforms. Usability testing demonstrated high user satisfaction, with actionable insights guiding iterative improvements.*

Abstrak. Penelitian ini mengeksplorasi perancangan aplikasi berbasis web untuk mendukung mahasiswa di Politeknik Hasnur dalam merencanakan startup menggunakan metodologi *Design Thinking*. Studi ini mencakup lima tahap—Empathize, Define, Ideate, Prototype, dan Test—untuk secara komprehensif memenuhi kebutuhan pengguna dan menciptakan solusi inovatif. Data dikumpulkan melalui survei, observasi, dan wawancara yang melibatkan mahasiswa. *Brainstorming*, SCAMPER, *Six Thinking Hats*, *heuristic evaluation*, dan *usability testing* digunakan untuk menyempurnakan dan memvalidasi hasil desain. Hasil penelitian mengungkap tantangan utama yang dihadapi mahasiswa, termasuk kesulitan dalam mencocokkan tim, mengakses materi pembelajaran terstruktur, dan mengelola proyek startup. Fitur yang diusulkan meliputi algoritma pencocokan berbasis kata kunci, pusat pembelajaran dengan daftar periksa untuk melacak kemajuan, *kanban board* untuk manajemen proyek, serta sistem mentoring fleksibel yang terintegrasi dengan platform eksternal. Pengujian kegunaan menunjukkan tingkat kepuasan pengguna yang tinggi, dengan wawasan yang dapat ditindaklanjuti untuk perbaikan iteratif.

INTRODUCTION

In the digital era, startups have become key drivers of economic growth. However, students often face challenges in building startups due to a lack of collaboration, mentorship, and practical experience. This research aims to design a web-based application UI/UX using the Design Thinking approach to support students at Politeknik Hasnur in startup planning processes. The five stages of Design Thinking include Empathize, Define, Ideate, Prototype, and Test, providing a structured framework to create user-centric solutions.

LITERATURE REVIEW

User Interface (UI) dan User Experience (UX)

User Interface (UI) focuses on visual elements that assist users in interacting with the system. A well-designed UI should be consistent, intuitive, and responsive (Stone et al., 2005). Meanwhile, User Experience (UX) encompasses the overall experience of users, including comfort, ease, and satisfaction during the use of an application (ISO 9241-210, 2010).

Startup

Startups are newly established business ventures focusing on innovation and rapid growth. They often operate under conditions of high uncertainty and rely heavily on entrepreneurial drive (Ries, 2011). Key characteristics of startups include high adaptability, innovative approaches to problem-solving, and potential for scalability. Students engaged in startups often encounter challenges such as limited resources, lack of industry experience, and difficulties in building cohesive teams (Tolba, 2021). These challenges underscore the need for digital tools that support collaboration and mentorship, allowing students to effectively navigate the complex startup ecosystem.

Web-Based Applications

Web-based applications are software solutions accessible via web browsers, eliminating the need for installation on local devices (The Anatomy of Web Development, 2024). Such applications offer scalability, ease of updates, and cross-platform accessibility. They are especially suited for collaborative environments, providing centralized platforms for resource sharing, task management, and communication. By leveraging responsive design and integrated features, web-based applications can address the diverse needs of startup teams, such as real-time updates, project tracking, and mentor-student interactions.

Design Thinking Methodology

Design Thinking is an iterative approach aimed at creating user-centered solutions. The process includes five stages: *Empathize*, *Define*, *Ideate*, *Prototype*, and *Test* (Kurniawan et al., 2019). This approach effectively fosters innovation by involving users at every stage of development.

METHODS

Design Thinking Approach

The stages include:

1. **Empathize**: Identifying user needs through surveys, interviews, and observations.
2. **Define**: Formulating problems based on user data.
3. **Ideate**: Generating creative ideas as potential solutions.
4. **Prototype**: Developing wireframes and high-fidelity designs to visualize solutions.
5. **Test**: Validating prototypes through heuristic evaluation and usability testing.

Data Collection

To gather a comprehensive understanding of student needs and challenges in startup planning, the following methods were employed:

- **Survey:** Involving 52 students to understand their needs and challenges.
- **Observation:** Conducted in workshops to observe team dynamics.
- **In-depth Interviews:** Engaging 5 students for more specific insights.

RESULTS

Empathize Stage

The Empathize Stage serves as the foundation for understanding user needs, challenges, and motivations in the context of startup planning and collaboration. This stage employs a combination of surveys, observations, and in-depth interviews to gather diverse insights from students with varying levels of experience.

Survey

The survey revealed key insights from two groups: those with startup experience ("Yes") and those without ("No"). Respondents with experience, primarily serving as Founders (44.44%) and Team Developers (33.33%), highlighted strong motivation to contribute to idea development and technical aspects but faced challenges in maintaining team collaboration and securing funding. The "No" group, while expressing significant interest in future projects (74.42% "Yes," 25.58% "Maybe"), reported barriers such as uncertainty on where to start (62.79%) and lack of mentorship. Both groups agreed on the importance of developing practical skills, though the "No" group valued institutional support while the "Yes" group emphasized networking and industry exposure. Collaboration applications were seen as tools to enhance learning and efficiency, with the "No" group focusing on guidance and mentoring features, and the "Yes" group favouring advanced project management and progress-tracking tools.

Observation

The observation was conducted during a workshop involving 51 students from Informatics Engineering and Digital Business departments, who formed 17 teams to complete startup-related

tasks. Activities included team formation, brainstorming startup ideas, and presenting these ideas to facilitators and peers. The analysis revealed that most teams proposed simple and familiar ideas, such as marketplace or educational services, and discussions were often dominated by one or two members. Challenges included difficulty in generating unique ideas within a limited timeframe and presenting them clearly. Active contributors who demonstrated significant involvement in idea generation, led discussions, or effectively communicated during presentations were identified as candidates for follow-up interviews, with five students selected. Overall, the observation highlighted a need for structured guidance and collaborative tools to support brainstorming and idea evaluation processes.

In-Depth Interview

In-depth interviews were conducted to gain a deeper understanding of students' experiences, needs, and expectations regarding an application that could support startup formation and management processes. Five participants with diverse backgrounds and experiences were selected, focusing on key areas such as startup experience, planning and collaboration, use of collaborative tools, user experience, challenges, and desired features.

Table 1. The Findings from The Interviews

Category	P1	P2	P3	P4	P5
Startup Experience	Founder of several startups, including skincare and digital marketing.	Interned at digital marketing startups as a content planner.	Founder of a startup but faced resource constraints.	No direct experience but highly interested in starting a venture.	No experience but eager to join startups for exposure.
Startup Planning	Uses OKR, SWOT, and Validation Board methods.	Basic team discussions during internships.	Familiar with BMC and SWOT but lacked resources for execution.	Limited to basic concepts, requiring guidance for initial steps.	Interested in learning startup planning through hands-on experience.
Collaborative Tools	Relies on Microsoft Word/Excel but struggles with navigation.	Uses Google Docs/Sheets but needs progress-based features.	Uses Notion and Google Docs, needing a project dashboard for tracking.	Uses WhatsApp, Canva, and GitHub but faces technical challenges.	Primarily uses Google Docs, but connectivity issues arise.
User Experience	Finds Microsoft tools unintuitive, slowing learning.	Google tools help but lack post-task evaluation feedback.	Prefers Google tools for simplicity, but Notion feels overly complex for team members.	GitHub feels hard to use without clear documentation.	Google Docs struggles with slow connections; needs a responsive, structured platform.
Challenges in Collaboration	Needs interactive	Struggles with mentor	Notion is overwhelming	Miscommunication in GitHub	Connectivity issues hinder

	tutorials for advanced Microsoft features.	communication; flexible mentoring is essential.	for new users; needs automated team matching.	workflows; needs better project tracking features.	collaboration; seeks peer-sharing tools.
Needs and Expectations	Seeks an app with idea publication to attract mentors and team members.	Desires offline access and self-assessment quizzes post-learning.	Prefers an app with team progress stats, project tracking, and matching accuracy.	Needs fast communication tools and external sharing features for project management.	Wants algorithm-based team matching and seamless calendar/email integration.

As summarized in Table 1, the interviews revealed key challenges students face, including difficulty finding suitable team members, limited access to support resources, and lack of experience in effective project management. Students highlighted the need for a platform that facilitates structured communication, collaboration, and learning. The data gathered from these interviews provides essential input for designing a technology-driven solution tailored to students' actual needs.

Empathy Map

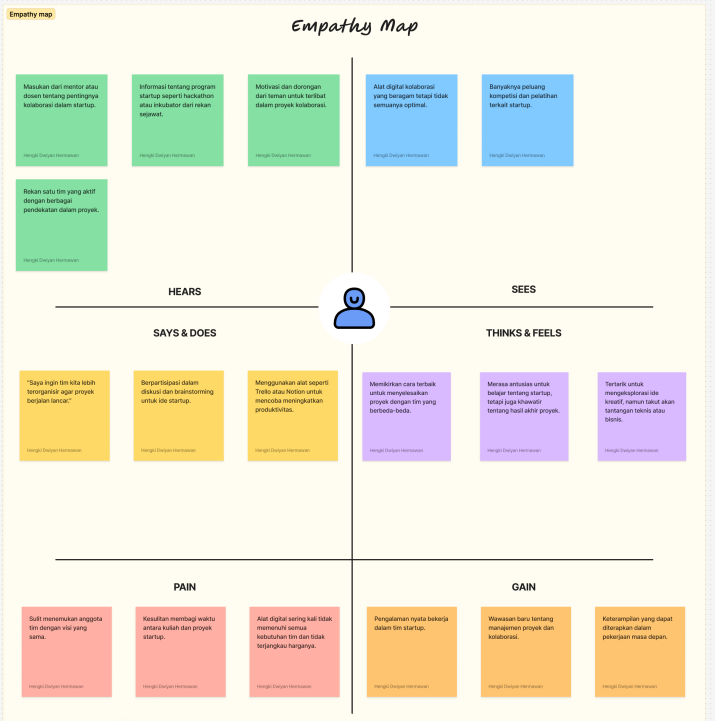

Figure 1. Empathy Map

Figure 1 presents an empathy map designed to visualize user insights. This map illustrates what users think, feel, see, hear, say, and do during the startup planning process. The empathy map provides a comprehensive understanding of user perspectives and needs, serving as a foundation for developing relevant, user-centered solutions.

Key Aspects of the Empathy Map:

- **Hears**: Key points heard about startups.
- **Sees**: Visual representations of startups within the environment.
- **Says & Does**: Actions and statements made in the context of startups.
- **Thinks & Feels**: Thoughts and feelings associated with collaboration and startup challenges.
- **Pain**: The primary challenges faced during startup planning.
- **Gain**: The benefits or expectations regarding startup solutions.

The empathy map highlights key challenges and opportunities faced during startup planning. Challenges include difficulty finding team members who share the same vision, limited access to effective digital tools for collaboration, and struggles to balance academic responsibilities with startup projects. Despite these obstacles, students are motivated by the opportunity to gain real-world experience, learn collaborative skills, and acquire practical knowledge applicable to future endeavors. They expect a platform that facilitates team collaboration, offers efficient team-matching features, and provides structured learning resources to support their understanding of startup processes. These insights underline the need for a solution tailored to addressing these challenges while fostering collaboration and learning.

Define Stage

The Define Stage focuses on translating insights from the Empathize Stage into actionable narratives that guide the development process. This stage aims to map user needs into structured scenarios, ensuring that proposed solutions address key challenges and align with user expectations.

User Stories

The creation of user stories aims to map user needs into simple and focused scenarios. By using this approach, application development can be structured according to the needs of students. User stories reflect the user experiences envisioned in the application and serve as the foundation for feature development. This process involved in-depth analysis of survey results, observations, interviews, and empathy map creation. Each user story describes specific user needs, especially students as the primary target audience. Stories were framed with the structure "As a user, I want [goal] so that [benefit]" to ensure alignment between proposed features and their intended purpose.

The following are the user stories categorized by the main application features:

1. **Matching Feature for Team Search**:
   - As a student, I want to fill out a profile with my skills and desired position to be matched with a suitable team.
   - As a student, I want to view a list of recommended students based on their skills so I can choose the right team members.

- As a student, I want to set matching preferences (e.g., location, work schedule, startup interests) so that the matching results are more relevant.
- As a student, I want to receive notifications if someone invites me to join their team.
- As a student, I want to provide feedback on the matching system to improve future accuracy.

2. **Student Learning Hub**:
   - As a student, I want to access learning resources organized by category (e.g., ideation, market validation, pitching) so I can learn step by step.
   - As a student, I want to save or bookmark favourite learning materials for easy access later.
   - As a student, I want to see recommended learning materials based on my progress in the application.
   - As a student, I want to download learning materials in PDF format so I can read them offline.
   - As a student, I want to complete quizzes or small tasks after studying materials to measure my understanding.

3. Project/Startup Feature:
   - As a student, I want to upload my startup idea with a description, team needs, and project timeline so others can understand my vision.
   - As a student, I want to receive recommended team members based on the skills I need for my project.
   - As a student, I want to get feedback from mentors on my startup idea to improve my plan.
   - As a student, I want to see a list of team members interested in my idea so I can select who to invite.
   - As a student, I want to update my project's progress status (e.g., ideation, MVP, final product) so others know my progress.
   - As a student, I want to publish my startup idea in the community within the platform to attract mentors or other students to join.

4. Mentoring Feature:
   - As a student, I want to view a list of mentors categorized by their expertise (e.g., marketing, technology, legal) so I can choose a suitable mentor.
   - As a student, I want to see a mentor's profile, including their experience and availability, before requesting a mentoring session.
   - As a student, I want to schedule a mentoring session with a mentor to discuss the challenges I face.

The user stories provide a clear framework for application feature development. By understanding user needs through these stories, the application can be designed to deliver relevant

solutions and assist students in their journey of building a startup. This approach also ensures that the developed features genuinely benefit the target users.

Ideate Stage

The Ideate Stage focuses on generating innovative ideas and exploring potential solutions based on the insights gathered from the Define Stage. This stage encourages creativity and collaboration, utilizing structured methods to ensure the solutions align with user needs and address identified challenges. Various ideation techniques, including brainstorming, SCAMPER, and Six Thinking Hats, were employed to refine concepts and prioritize features for the application.

Brainstorming

Brainstorming is done for generating key ideas for features in a web-based application. A web-based platform was chosen to ensure broader accessibility for students without dependency on specific devices. The brainstorming process resulted in the following core ideas:

1. **Matching Feature**: A team matching system based on project needs and student profiles, designed without messaging features to simplify usage.
2. **Learning Hub:** Learning materials linked to external resources, with a checklist feature to track learning progress.
3. **Project/Startup Feature:** Project management using a simple kanban board, with optional integration to external platforms like Trello or Notion.
4. **Mentoring Feature:** Students can select mentors from an available list, with scheduling and mentoring sessions conducted through external platforms like Zoom or Meet.

SCAMPER

After brainstorming generated initial ideas, the next step was using the SCAMPER method to develop these ideas further. SCAMPER (Substitute, Combine, Adapt, Modify, Put to Another Use, Eliminate, Reverse) is a creative exploration framework used to refine ideas by modifying, combining, or even reversing the initial approach.

SCAMPER was applied to each of the main application features as follows:

1. **Matching Feature for Team Search**:
   - *Substitute*: Replace text-based descriptions with keyword- or filter-based matching for project needs.
   - *Combine*: Integrate skill matching with automatic team member recommendations based on project history.
   - *Adapt*: Adjust the matching algorithm to consider additional preferences like location or specific project interests.
   - *Modify*: Enhance the visual design of matching results using student profile cards.

- *Put to Another Use*: Utilize the matching system to recommend mentors based on project needs.
- *Eliminate*: Remove in-app messaging to avoid redundancy with common communication platforms like WhatsApp.
- *Reverse*: Reverse the approach by allowing team members to search for projects to join.

2. **Student Learning Hub**:
   - *Substitute*: Replace file-uploaded learning materials with external resource links (e.g., YouTube, articles).
   - *Combine*: Merge learning features with progress-based recommendations for resource categories.
   - *Adapt*: Simplify progress tracking with a checklist interface.
   - *Modify*: Convert the material list into a visually appealing card-based layout for easier navigation.
   - *Put to Another Use*: Use learning progress data to recommend additional mentors or resources.
   - *Eliminate*: Exclude integrated learning modules requiring extensive development time.
   - *Reverse*: Reverse the process by allowing mentors or peers to assign specific learning materials to students before mentoring.

3. Project/Startup Feature:
   - *Substitute*: Replace integrated project management tools with a minimalist kanban board for simplicity.
   - *Combine*: Connect the kanban board with external platforms like Trello or Notion for flexibility.
   - *Adapt*: Tailor the kanban board for diverse project types, including ideation and implementation phases.
   - *Modify*: Simplify project workflows to enable easy addition of team members through system recommendations.
   - *Put to Another Use*: Use project features to track startup milestones and provide progress reports to mentors.
   - *Eliminate*: Exclude direct collaboration tools in favor of integration with external systems.
   - *Reverse*: Reverse the workflow by having mentors propose project challenges for students to work on.

4. Mentoring Feature:
   - *Substitute*: Replace integrated mentoring processes with external platforms like Zoom or Meet for session execution.

- *Combine*: Pair mentoring schedules with a visible calendar for students to choose suitable slots.
- *Adapt*: Customize mentoring options to allow students to select mentors based on project categories.
- *Modify*: Enhance mentor profiles with detailed information on expertise, experience, and availability.
- *Put to Another Use*: Leverage mentoring data to recommend compatible startup projects to specific mentors.
- *Eliminate*: Exclude in-app chat for mentoring to focus interactions on external platforms.
- *Reverse*: Reverse the dynamic by enabling mentors to choose students based on their needs and interests.

The SCAMPER process yielded innovative and practical solutions for each primary feature of the application. The matching feature employs a keyword-based system to match team members effectively, enhanced by profile visualizations while omitting in-app messaging to avoid redundancy. The learning hub is designed to provide external links to resources with simple progress-tracking checklists, ensuring ease of access and efficient learning management. The project management feature uses a minimalist kanban board that integrates seamlessly with external tools such as Trello or Notion, offering flexibility without overcomplicating the interface. Lastly, the mentoring feature leverages external platforms like Zoom or Meet for scheduling and session management, ensuring a user-friendly and familiar environment for both students and mentors.

Six Thinking Hats

After ideas were developed using the SCAMPER method, the next step was to comprehensively evaluate these solutions using the Six Thinking Hats method. This approach enables analysis from multiple perspectives to ensure that the designed solutions are not only innovative but also relevant, practical, and aligned with user needs.

1. **Matching Feature for Team Search**:
   - **White Hat (Facts)**: Students require a fast and relevant system to match team members based on skills. Accurate and structured student profile data is crucial to support the matching algorithm.
   - **Red Hat (Emotions)**: Students feel satisfied when matching results meet their needs. Frustration can arise if matches are irrelevant or too generic.
   - **Black Hat (Risks)**: The matching algorithm may underperform if user profiles are incomplete or outdated. Without a messaging feature, students might find it difficult to initiate communication.
   - **Yellow Hat (Benefits)**: Keyword-based matching simplifies finding suitable team members. The absence of messaging redirects students to familiar communication platforms like WhatsApp.

- **Green Hat (Creativity)**: Add visualized results, such as profile cards highlighting skills. Enable students to rate match relevance to improve the algorithm.
- **Blue Hat (Process)**: The next step is to test the matching algorithm with real users to assess its accuracy and relevance.

2. **Student Learning Hub**:
   - **White Hat (Facts)**: Students prefer external learning resources as they are practical and rich in references. Checklists help track learning progress.
   - **Red Hat (Emotions)**: Students feel accomplished when material is relevant to their needs. Disappointment arises if external links are inactive or of low quality.
   - **Black Hat (Risks)**: External links may become obsolete. A simple system might lack appeal for some students.
   - **Yellow Hat (Benefits)**: Link-based learning reduces the burden of content management. Checklists provide a sense of achievement.
   - **Green Hat (Creativity)**: Add recommendations based on student progress. Allow students to rate or comment on learning links.
   - **Blue Hat (Process)**: Periodic checks ensure the relevance and quality of external links.

3. Project/Startup Feature:
   - **White Hat (Facts)**: Students need a simple and flexible project management tool. Integration with external tools like Trello or Notion allows broader collaboration.
   - **Red Hat (Emotions)**: Students enjoy the flexibility of familiar tools but may feel dissatisfied if the kanban board is too basic.
   - **Black Hat (Risks)**: Dependence on external tools could be problematic if integration fails. A simple kanban board might not support complex projects.
   - **Yellow Hat (Benefits)**: Minimalist kanban boards ensure the application remains lightweight and easy to use. External integration adds flexibility.
   - **Green Hat (Creativity)**: Link project milestones to the kanban board. Provide simple templates to help students get started.
   - **Blue Hat (Process)**: Test the kanban board with a small group of students to evaluate its utility.

4. Mentoring Feature:
   - **White Hat (Facts)**: Students require easy access to mentors with flexible schedules. Mentoring sessions are conducted via external platforms like Zoom or Meet.
   - **Red Hat (Emotions)**: Students appreciate the scheduling flexibility. Mentors feel comfortable using familiar platforms.
   - **Black Hat (Risks)**: Conducting mentoring outside the platform might result in a lack of control and data for the application. Scheduling miscommunication could occur.

- **Yellow Hat (Benefits)**: Flexible mentoring improves student and mentor comfort. This system is easier to implement without integrated communication features.
- **Green Hat (Creativity)**: Add a feature to record mentoring session outcomes in the application for student reference. Implement notifications to remind students about mentoring schedules.
- **Blue Hat (Process)**: Test the scheduling system with mentors and students to ensure convenience and efficiency.

The evaluation using Six Thinking Hats ensures that the designed solutions consider various aspects, including facts, user emotions, risks, opportunities, creativity, and implementation processes. The next step is to prioritize the most relevant features and test prototypes with real users to ensure these solutions effectively support students in planning their startups.

Ideation Stage Conclusion

The ideation phase concluded with the identification of key solutions aimed at addressing the challenges faced by students during the startup planning process. These solutions focus on improving collaboration, learning efficiency, and project management. Below are the refined outcomes:

1. **Matching Feature**: A keyword-based matching algorithm simplifies the search for team members. Profile card visualization enhances appeal.
2. **Learning Hub**: A resource system linked to external sites with checklist progress features facilitates learning.
3. **Project Management**: A minimalist kanban board provides flexibility in project management.
4. **Mentoring**: Scheduling mentoring sessions through external platforms like Zoom, with integrated session notes in the app.

These solutions aim to enhance the efficiency of collaboration, learning, and project management for students. Future studies will focus on *Prototype* and *Test* stages to validate and refine the proposed solutions.

Prototype Stage

The proposed solutions aim to improve collaboration, learning, and project management efficiency for students. Future research will focus on the *Prototype* and *Test* stages to validate these solutions and refine them based on user feedback.

Wireframe and Design System

Wireframes were developed to outline the application structure and navigation without aesthetic details. These initial representations focused on core features:

1. **Matching Feature**

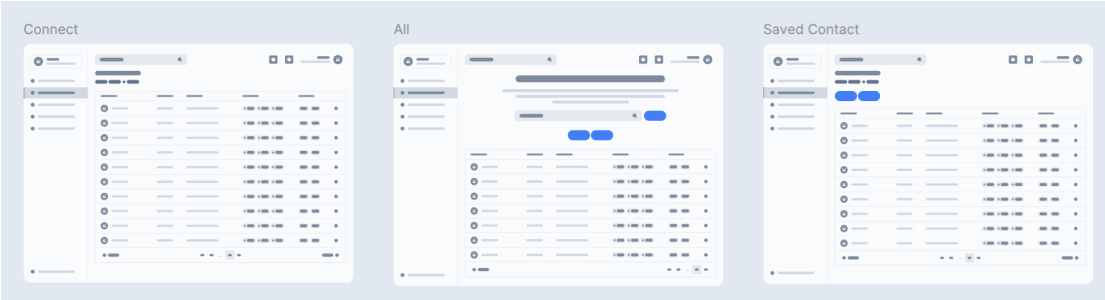

Figure 2. Matching Feature Wireframe

Matching feature in Figure 2 is visualized as a team-matching page with a list of team members and keyword search functionality.

2. **Learning Hub**

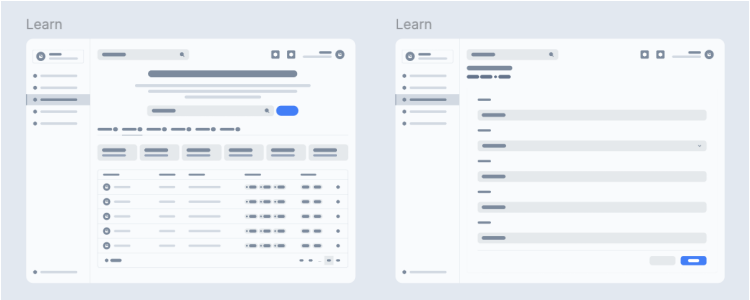

Figure 3. Learning Hub Wireframe

Learning Hub in Figure 3 is displayed as an organized resource list with categories and a checklist for tracking progress.

3. **Project Management**

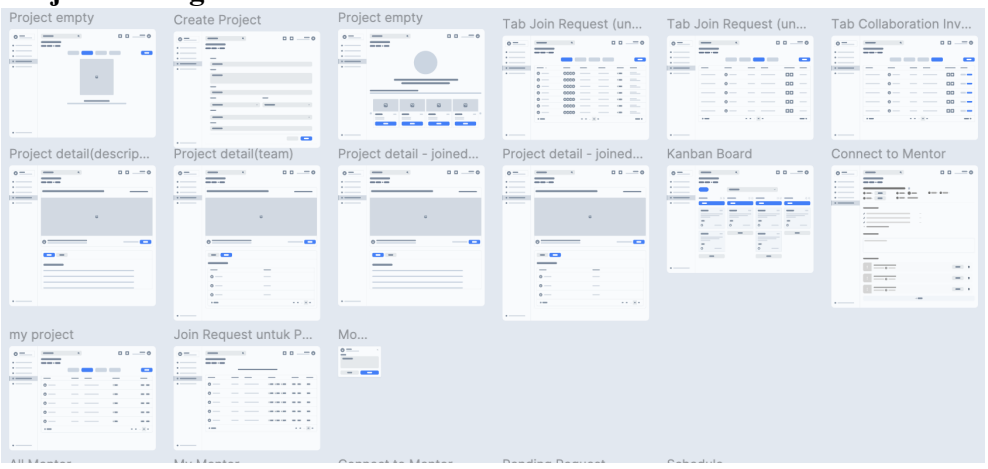

Figure 4. Project Management Wireframe

Project management in Figure 4 is designed as a minimalist kanban board for project management.

4. **Mentoring**

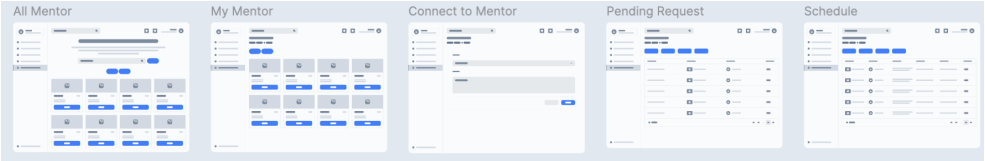

Figure 5. Mentoring Wireframe

Mentoring in Figure 5 showcased a mentor list with schedulable sessions.

A design system was created to ensure consistency across interface elements, including:

1. **Color Palette**

Figure 6. Color Palette

Primary, secondary, and accent colors reflecting the application's identity as shown in Figure 6.

2. **Typography**

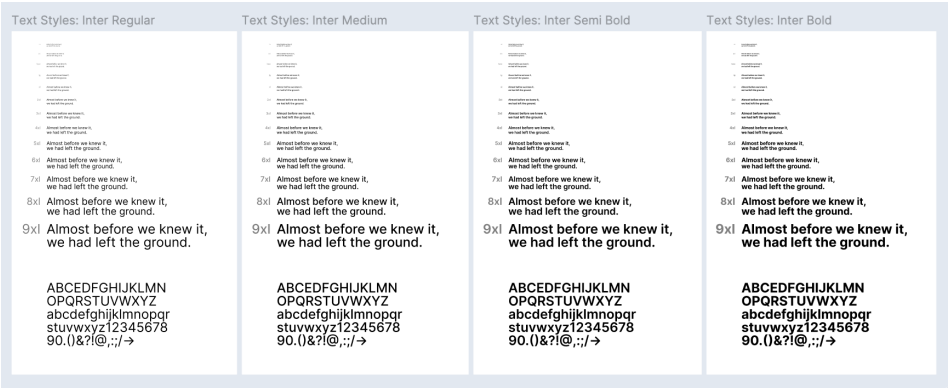

Figure 7. Typography

Selected fonts for headings, subheadings, and body text to ensure readability and professionalism as shown in Figure 7.

3. **Iconography**

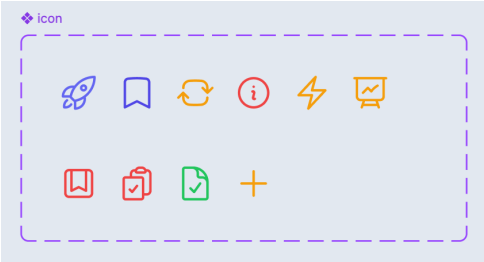

Figure 8. Iconography

A set of icons for intuitive navigation and interaction as shown in Figure 8.

4. **UI Components**

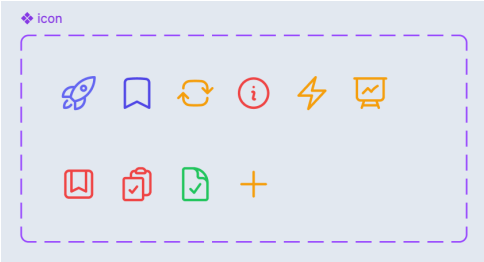

Figure 9. UI Components

Buttons, input fields, cards, and modals for a cohesive user experience as shown in Figure 9.

High-Fidelity Design

After finalizing the wireframe and design system, high-fidelity designs were created to simulate the application's final appearance. Each feature was meticulously visualized with detailed layouts, colors, and interactive elements:

1. **Matching Feature**

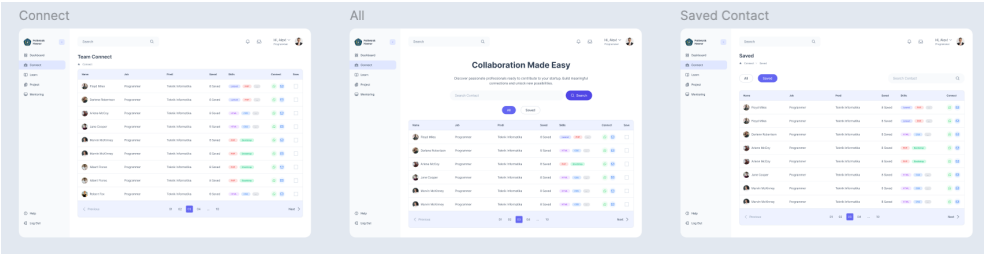

Figure 10. Matching Feature High-Fidelity Design

Matching Feature in Figure 10 highlighted team members' skills with keyword search functionality.

2. **Learning Hub**

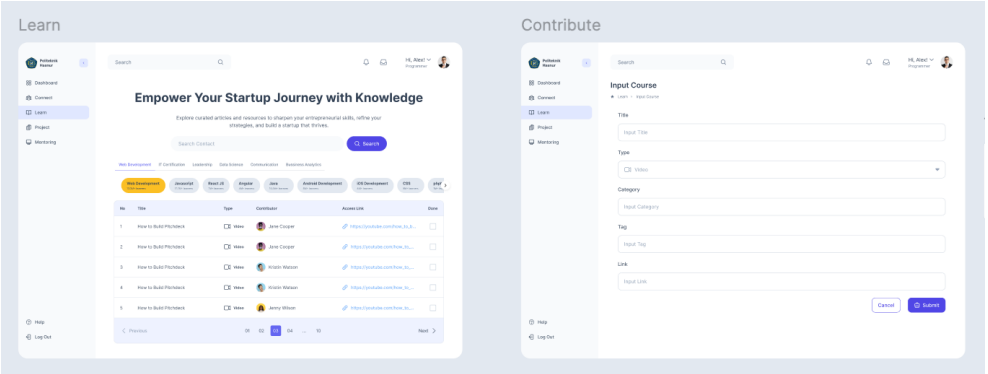

Figure 11. Learning Hub High-Fidelity Design

Learning hub in Figure 11 Integrated intuitive navigation and progress tracking.

3. **Project Management**

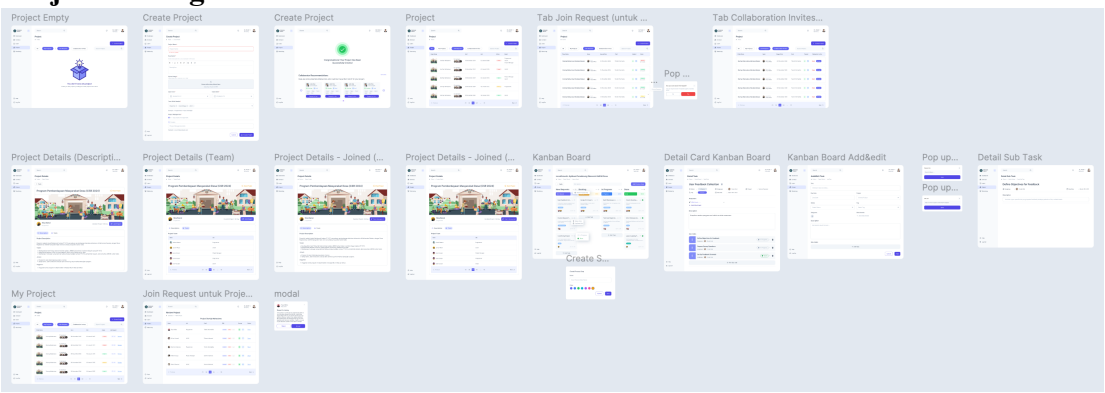

Figure 12. Project Management High-Fidelity Design

Developed a user-friendly kanban board for streamlined project management as shown in Figure 12.

4. **Mentoring**

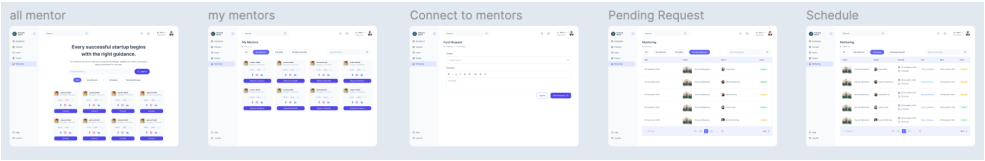

Figure 13. Mentoring High-Fidelity Design

Mentoring in Figure 13 shows mentor profiles with availability and scheduling options.

Interactive prototypes were built to visualize user interactions, including hover effects, page transitions, and navigation. These prototypes allowed stakeholders to experience the application's functionality and provided a basis for further refinement.

Test Stage

The Test stage is a critical phase in the Design Thinking process, designed to evaluate and validate prototypes with real users. This phase involves gathering feedback to ensure the proposed

solutions align with user needs and improve usability. Two methods were used in this stage: Heuristic Evaluation and Usability Testing.

Heuristic Evaluation

Heuristic Evaluation involves systematic assessments based on established usability principles, without requiring direct user participation. Three evaluators independently examined the prototype, focusing on Jakob Nielsen's 10 usability heuristics (Nielsen, 1993). Issues were categorized based on their violated heuristics and assigned severity levels.

The identified usability issues and recommendations were addressed systematically. Below is a summary of key improvements:

Table 2. Identified Usability Issues and Follow-up Improvements

No.	Issue Identified	Heuristic Principle	Action Taken
1	Missing error text for input validation	Visibility of System Status	Added error text for direct user feedback.
2	Inconsistent terminology	Consistency and Standards	Unified terminology for consistent messaging.
3	Lack of navigational feedback	Recognition Rather Than Recall	Introduced navigation aids for better flow.
4	Minimal help and documentation	Help and Documentation	Developed a structured help menu with FAQs.
5	Missing error text for input validation	Visibility of System Status	Added error text for direct user feedback.
6	Lack of feature explanation on the main page	Visibility of System Status	Added onboarding, tooltip, or welcome screen in the dashboard for user guidance.
7	Users cannot cancel incorrect team join requests	User Control and Freedom	Added an option to cancel requests before approval.
8	No file type validation for uploads	Error Prevention	Added descriptions of allowable file types, such as jpg, png, etc.
9	No project deadline indicator on the dashboard	Recognition Rather Than Recall	Added labels or visual indicators for approaching deadlines.
10	No option to save recurring task templates	Flexibility and Efficiency of Use	Added a feature to save frequently used task templates for quicker access.
11	Overly large tables in project pages	Aesthetic and Minimalist Design	Reduced table sizes for cleaner and more efficient layouts.
12	No error message when users enter invalid links	Help Users Recognize, Diagnose, and Recover from Errors	Added error messages explaining if a link is invalid.

13	No navigation back to the project page after viewing details	Recognition Rather Than Recall	Added a back button for easier navigation.
14	Error messages only display technical codes	Help Users Recognize, Diagnose, and Recover from Errors	Redesigned error messages to be more informative and provide recovery steps.
15	Inconsistent table designs on project pages	Consistency and Standards	Standardized table designs in size, color, and layout.
16	Missing tooltips or guides for dashboard features	Visibility of System Status	Added tooltips to help users understand each feature's functionality.
17	No design for the Help menu	Help and Documentation	Created a structured Help page including guides, FAQs, and tutorials.

Table 2 highlights the strategic follow-up actions implemented to address identified usability issues. These actions improved navigation, visual consistency, and enhanced feedback, providing an overall better user experience.

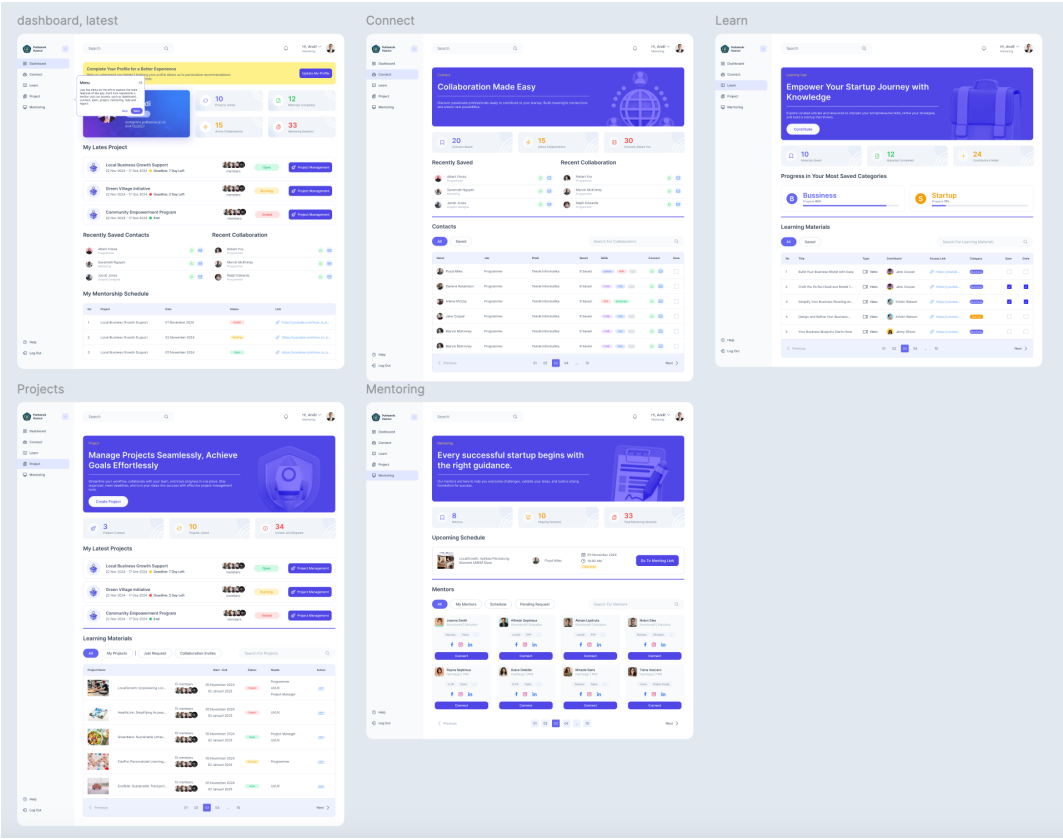

Figure 14. Implementation Example

The follow-up actions, as shown in Figure 14, represent a vital part of the iterative design process. These changes ensure the prototype offers an intuitive, efficient, and user-focused experience for its audience.

Usability Testing

Usability Testing evaluates how effectively real users interact with the prototype. This method focuses on identifying usability issues, measuring efficiency, and gathering user satisfaction data. Five participants, representing the target audience, completed specific tasks while their interactions were observed and analyzed. After testing, participants rated their experiences using the System Usability Scale (SUS).

TABLE 3. Usability Testing Result

Participant	SUS Score
P1	77.5
P2	82.5
P3	87.5
P4	75.0
P5	95.0
Average	**83.5**

The average SUS score of 83.5 as shown in Table 3 indicates high user satisfaction and usability. Most participants successfully completed tasks, such as team matching, accessing learning resources, and scheduling mentoring sessions.

CONCLUSION

This study examined the design of a web-based application to support students at Politeknik Hasnur in startup planning, utilizing the complete Design Thinking methodology. The research covered all five stages—Empathize, Define, Ideate, Prototype, and Test—ensuring comprehensive understanding and resolution of user challenges, with a focus on user interface (UI) and user experience (UX) principles.

- **Empathize Stage**: Surveys, observations, and in-depth interviews identified core challenges, such as difficulties in forming teams, accessing structured learning resources, and managing startup projects. These insights provided the foundation for developing solutions tailored to user needs.
- **Define Stage**: User stories were crafted to translate user needs into actionable goals, categorized by key features including team matching, learning hubs, project management, and mentoring. This stage ensured that the application design remained focused on addressing specific challenges faced by students, mentors, and administrators.
- **Ideate Stage**: Creativity methods such as brainstorming, SCAMPER, and Six Thinking Hats refined the design concepts into innovative solutions. Proposed features included a keyword-based team matching system, a progress-tracking learning hub, a minimalist

kanban board for project management, and flexible mentoring integration with external tools.

- **Prototype Stage**: Wireframes and high-fidelity prototypes were developed to visualize the proposed solutions. Consistency in UI design was achieved through a comprehensive design system, ensuring seamless navigation and improved user interaction.
- **Test Stage**: Usability testing demonstrated high user satisfaction, with an average System Usability Scale (SUS) score of 83.5. Heuristic evaluations provided actionable feedback, leading to enhancements in navigation, feedback systems, and error prevention, further aligning the application with user expectations.

The integration of all five stages and adherence to UI/UX design principles demonstrated the effectiveness of Design Thinking in addressing complex user needs. The proposed application successfully enhances collaboration, learning accessibility, and project management efficiency for students planning startups. Future research will focus on deploying the application in real-world scenarios, analyzing its long-term impact on the startup ecosystem, and exploring potential scalability to other educational institutions.

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