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Development of an Android Mobile Application for Capital Market Education: A Case Study at *KSPM UTY*

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ABSTRACT

This study explores the development of an Android mobile application to enhance capital market education within the Capital Market Study Group (KSPM) at Yogyakarta Technology University (UTY). The application aims to provide members with accessible and structured learning resources, including downloadable materials, interactive quizzes, and discussion forums. The system defines three main user roles that is: members, management, and super admin. Members can see and download capital market materials and quizzes to evaluate their understanding, while management oversees manage of capital market materials. The super admin role is responsible for overall user management and monitoring bug reports. The system utilizes Firebase as its database to enable real-time data management and synchronization, ensuring reliability. The implementation of this application has demonstrated its effectiveness in fostering better understanding of capital market concepts among KSPM members. This development represents a significant step toward more interactive and efficient learning methods, contributing to advancements in educational technology.

Keywords: *Capital market, Mobile application, Learning media, Information technology, Education.*

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INTRODUCTION

The capital market is a fundamental instrument in a country's economic development, providing companies with crucial access to funding while offering investors opportunities for profit (Ige & Washington, 2023). For students in economics, finance, or business, having a robust understanding of the capital market is essential (Kabbach-de-Castro et al., 2022). This knowledge helps them master investment principles, market analysis, and portfolio management strategies. However, effective learning about the capital market is often hindered by challenges related to traditional teaching methods (Wang & Cao, 2024).

The Capital Market Study Group at Universitas Teknologi Yogyakarta (KSPM UTY) has a significant role in educating its members about capital markets. Despite its efforts, KSPM UTY currently lacks a centralized and easily accessible digital learning platform (Vebrianto Susilo et al., 2020). This limitation forces members to independently search for resources, which are often fragmented and difficult to study in a comprehensive manner (Aisyah Hidayati & Bintang Mandala Putra, 2021). The absence of structured digital tools further affects interactive learning, such as quizzes and group discussions, reducing the effectiveness of the educational process (Tjahjamoorniarsih et al., 2023).

To address these limitations, this study proposes the development of a mobile application specifically designed for capital market learning at KSPM UTY (Ro'fati & Rahayuningsih, 2023). The application aims to provide comprehensive access to learning materials, interactive quizzes, and a platform for group discussions (Nugraha & Aminur Rahman, 2021). It will include three main user roles: members, management, and super admin. Members can download and engage with materials, participate in quizzes, and join group discussions to enhance their understanding.

Management will be responsible for creating and maintaining educational content, ensuring the learning resources are relevant and up-to-date. The super admin role will oversee the system, manage user access, and monitor bug reports to maintain the app's functionality and security. This approach ensures that all user roles can contribute effectively to the educational process and promotes a more structured, interactive learning environment (Faqih, 2020).

According (Aditama et al., 2021)conducted a study focusing on the user experience design of a mobile-based investment learning application using the Design Thinking methodology. The research demonstrated that applications developed with a user-centric approach could greatly enhance user engagement and satisfaction. By integrating Design Thinking, the study highlighted the importance of iterative feedback and continuous refinement to align with user needs. This approach emphasizes the value of crafting applications that are not only functional but also intuitive and engaging for learners (Huang, 2023).

According (Wisnuputra & Anwar, 2023)developed an Android-based stock analysis application leveraging fuzzy logic to assist investors. Their tool was specifically designed to help users minimize investment risks and improve decision-making processes. The application showcased the capability of mobile platforms to handle complex data analysis, reinforcing their potential in delivering strategic financial insights. This development underlined the practical applications of mobile technology in enhancing analytical capabilities for better investment outcomes (Murdowo et al., 2021).

According (Piliang & Sariana, 2020) explored Firebase as a robust Backend-as-a-Service (BaaS) platform, emphasizing its suitability for real-time data management and synchronization. Their findings pointed to Firebase's comprehensive services that support seamless data handling and scalability, which are essential for modern application

development. The research highlighted how Firebase's architecture supports applications that require consistent data flow and high reliability. This aligns well with the needs of interactive learning platforms, making it an ideal choice for educational apps that require live updates and reliable performance.

The mobile application developed to capital market learning within the Capital Market Study Group (KSPM) at Yogyakarta Technology University effectively aligns with the principles outlined in previous research (Hidayat & Kayati, 2020). This system provides structured and accessible learning resources, like this downloadable materials, interactive quizzes, and discussion forums, thereby facilitating an improved learning experience. The implementation of Firebase as the database for real-time data management ensures reliability and consistent data flow, which is essential for the application's interactive features (Jang & Suh, 2022). Furthermore, the clear definition of three user roles members, management, and super admin for enhances personalized user experiences.

METHOD

Figure 1 below illustrates the research flow, outlining each phase involved in the development process. This diagram provides a clear visual of the sequential steps, from initial data collection through to system testing. By following this structured approach, the study aims to ensure a comprehensive understanding of user needs, effective system design, and rigorous testing for optimal functionality.

Figure 1: Research Flow

1. Interview and Observation

This phase begins with interviews and observations to thoroughly explore system requirements. Interviews are conducted with members and administrators of the UTY Capital Market Study Group (KSPM) to understand the specific needs for supporting capital market learning processes. Direct observations are carried out to see firsthand how capital market learning activities take place in KSPM UTY. The results of these interviews

and observations serve as the foundation for designing features and functions that align with user needs.

2. System Design

In the system design phase, the technical aspects of the system to be developed are structured and planned. This includes creating a Use Case Diagram to define the interactions between users and the system, as well as identifying functional and non-functional requirements. Functional requirements outline the key features that the system must provide, while non-functional requirements cover aspects such as security, performance, and usability. This design serves as a blueprint for the implementation or coding phase.

3. Coding

This stage involves the actual development of the system in accordance with the established design. During coding, all components and features outlined in the design phase are implemented using the appropriate programming language and technologies. Each part of the system is developed in stages to ensure it meets functional requirements and aligns with the design. By the end of this phase, the system is expected to have its core features implemented and ready for functional testing.

4. Testing

Once coding is complete, the system is tested using the black-box testing method to verify that each function operates correctly. This testing approach involves evaluating the inputs and outputs of each feature without inspecting the underlying code. The results of this testing are used to ensure that the system meets the expected specifications and functions smoothly for users without any functional errors.

FINDING AND DISCUSSION

1. Interview & Observation

The study began with semi-structured interviews conducted with members and management of KSPM UTY to gather insights into user needs and expectations for the capital market learning application . Interviews were held separately to understand their roles, responsibilities, and desired features, including common challenges encountered in the learning process. Following the interviews, participatory observations were conducted to monitor user interactions with the application in real-world learning scenarios. Researchers observed how users accessed materials, took quizzes, and participated in group discussions. This observation process helped identify usage patterns, technical issues, and assess the user-friendliness of the application’s interface.

The interviews revealed that KSPM UTY members sought features that would enable centralized and structured access to learning materials. They expressed the need for downloadable PDF materials that could be accessed offline. Additionally, members highlighted the importance of interactive quizzes to assess their understanding of the

material. Management emphasized the need for content management features that would allow them to manage materials, add quizzes, and monitor user activity. They also emphasized the importance of a reporting feature to evaluate members' learning progress.

Following the interviews, the study proceeded with participatory observations to monitor user interactions with the application in daily learning activities. Researchers directly observed members using the application to access materials, complete quizzes, and engage in group discussions. The observations also examined technical aspects, including the application's response time, ease of navigation, and user reactions to the interface. Several technical issues were noted, such as difficulties in locating specific materials and slow response times when accessing quizzes. The observations also revealed usage patterns, including the amount of time members spent using the app and their frequency of participation in discussions. Based on the findings from the interviews and observations, the following key features were identified for development:

1. A feature enabling members to access and download learning materials in PDF format.
2. Interactive quizzes to assess members' understanding of the materials, with immediate feedback.
3. A group chat feature for both management and members to discuss and exchange information on the materials. This feature will facilitate easy question-asking and idea-sharing.
4. Content management features allowing management to add, edit, or delete materials and quizzes as needed.
5. A role management and bug reporting feature for super admins, enabling them to change user roles and monitor bug reports. When members are promoted to management, their roles in the system will be updated immediately.

2. System Design

Use Case Diagram

Figure 2 below presents the use case diagram, which illustrates user interactions with the application. This use case diagram delineates how application users engage with various features available in the capital market learning application. The use cases are categorized into several main functions, including managing materials, administering quizzes, and sending group chat messages, all relevant to the roles of management or users with specific access rights. Users can view, download materials, and answer quizzes, which are extensions of the material and quiz management features.

Additionally, there are registration and login features, which are prerequisites for other functions such as changing profile pictures, updating passwords, and logging out.

The super admin role encompasses the ability to manage user roles and view bug reports, which aids in the overall management of the application system. This diagram illustrates the comprehensive process flow within the application and how its features interconnect.

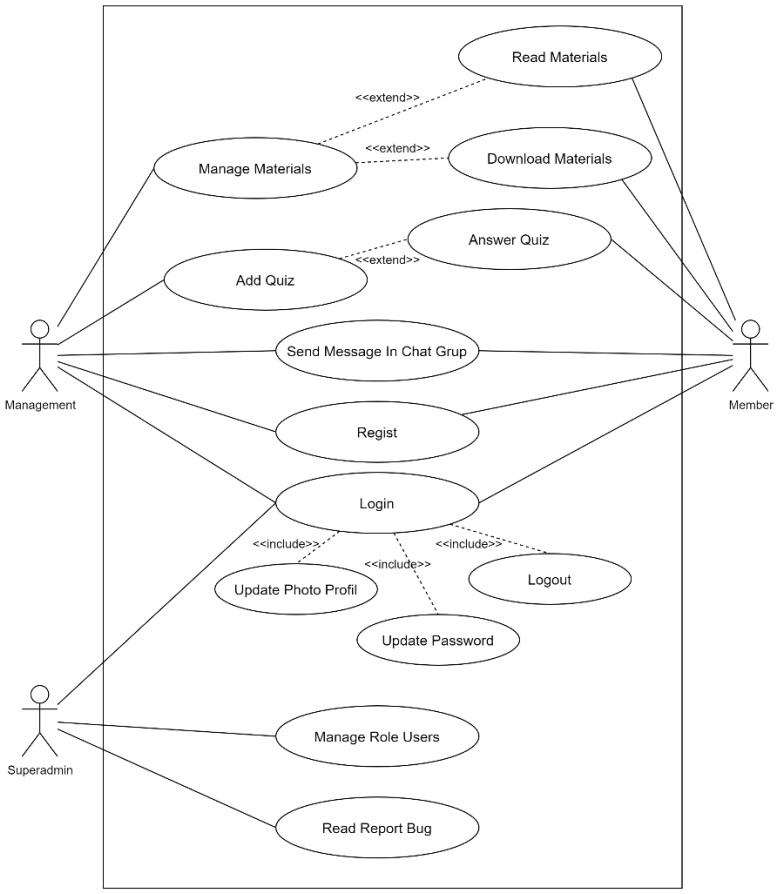


Figure 2: Use Case Diagram System

Functional Requirements

The functional requirements analysis relates to the information needed to build a capital market learning application. The functional requirements of this application include:

A. Input Requirements:
   a. The super admin can input data for the login form, registration form, and password recovery form.
   b. Administrators can input data for the login form, registration form, password recovery form, password change form, bug report form, capital market material form, group chat message form, and quiz input.

c. Members can input data for the login form, registration form, password recovery form, group chat message form, password change form, and bug report form.

B. Process Requirements:
   a. The super admin can log in and validate users to grant access rights as members or administrators.
   b. Administrators can log in, register accounts, and manage capital market materials.
   c. Members can log in, register accounts, download capital market materials, and complete quizzes.

C. Output Requirements:
   a. The super admin can view the roles of all users, whether administrators or members, and view bug reports submitted by system users.
   b. Administrators can view the capital market materials they have entered and view messages in the group chat.
   c. Members can view capital market materials, read messages in the group chat, and view their quiz results.

Non-Functional Requirements

Table 1 below outlines the importance of selecting appropriate non-functional requirements in system development to ensure optimal application performance and functionality. The comparison table highlights the hardware specifications of laptops and Android smartphones, where each component plays a crucial role in supporting the development process (Puspitasari et al., 2022). Laptops equipped with an AMD Ryzen 7 5000 processor and 8 GB of RAM offer higher computational capacity, facilitating multitasking and running resource-intensive applications. In contrast, smartphones with a Snapdragon 712 processor and lower specifications are more suitable for developing mobile applications that need to be optimized for use on smaller screens. Therefore, understanding these hardware requirements is a critical first step in creating an effective and efficient system (Bidin & Ziden, 2013).

Table 1: Non-Functional Requirement

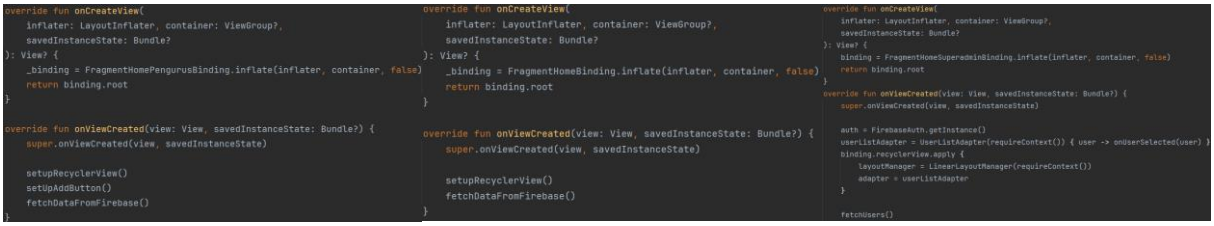
No	Hardware	Laptop	Smartphone Android
1	Processor	AMD Ryzen 7 5000 1.8 GHz	Snapdragon 712 Quad-Core
2	Screen	11 inch	5.99 inch
3	RAM	8 GB	4 GB

4	ROM	512 GB	62 GB
5	Camera	0.92 MP	48 MP

3. Coding

During the coding phase, the researcher began translating the application design schema into program code using Kotlin, the primary language for Android application development (Ejiyi et al., 2021). This process involved creating various UI (User Interface) components by the planned design, as well as writing the application logic to ensure all features function correctly. The researcher also integrated the application with the backend, utilizing Firebase as the database solution. Firebase manages data storage, user authentication, and real-time data processing.

In this context, the researcher needed to ensure that all data sent to and retrieved from Firebase was effectively managed. This included implementing user authentication mechanisms, such as login and registration, and ensuring that each role (management, member, and super admin) had appropriate access to functions and data within the application. The researcher conducted regular testing to verify that the written code performed as expected and that no errors disrupted the user experience. For example, Figure 3 includes a snippet of Kotlin code demonstrating the implementation of the main page for the management, member, and super admin roles. Below are some code examples for each role:



```
override fun onCreateView(
    inflater: LayoutInflater, container: ViewGroup?,
    savedInstanceState: Bundle?
): View? {
    _binding = FragmentHomePengurusBinding.inflate(inflater, container, false)
    return binding.root
}

override fun onViewCreated(view: View, savedInstanceState: Bundle?) {
    super.onViewCreated(view, savedInstanceState)

    setupRecyclerView()
    setUpAddButton()
    fetchDataFromFirebase()
}
```

```
override fun onCreateView(
    inflater: LayoutInflater, container: ViewGroup?,
    savedInstanceState: Bundle?
): View? {
    _binding = FragmentHomeBinding.inflate(inflater, container, false)
    return binding.root
}

override fun onViewCreated(view: View, savedInstanceState: Bundle?) {
    super.onViewCreated(view, savedInstanceState)

    setupRecyclerView()
    fetchDataFromFirebase()
}
```

```
override fun onCreateView(
    inflater: LayoutInflater, container: ViewGroup?,
    savedInstanceState: Bundle?
): View? {
    binding = FragmentHomeSuperadminBinding.inflate(inflater, container, false)
    return binding.root
}
override fun onViewCreated(view: View, savedInstanceState: Bundle?) {
    super.onViewCreated(view, savedInstanceState)

    auth = FirebaseAuth.getInstance()
    userListAdapter = UserListAdapter(requireContext()) { user -> onUserSelected(user) }
    binding.recyclerView.apply {
        layoutManager = LinearLayoutManager(requireContext())
        adapter = userListAdapter
    }

    fetchUsers()
```

Figure 3: Coding for Management, Member, Super admin Pages

4. Testing

Application testing is a crucial step in the software development lifecycle, aimed at ensuring that each feature functions properly and meets established specifications. One of the methods employed in this testing is Black-Box Testing, which focuses on the application's functionality without examining its internal structure or source code. The testing begins by understanding the application's specifications, including the features provided for each user role, such as members, management, and super admin.

Table 2 below presents a series of test scenarios conducted to evaluate the authentication system's functionality in an application. Each scenario simulates different

user actions during login, registration, and password recovery, with the expected results aimed at verifying the system's response accuracy. The results confirm that the system consistently displays appropriate error messages and navigations, ensuring a smooth and secure user experience.

Table 2: Testing Authentication Scenarios

No	Test Case	Expected Results	Test Results	Information
1	User login with valid credentials	The user successfully logs in and is directed to the main page according to the role.	Users are directed to the main page according to their role.	Pass
2	The user logged in with invalid credentials	The error message "Incorrect Username or Password" appears.	The error message "Incorrect Username or Password" appears.	Pass
3	The user did not fill in one of the email or login password forms	The error message “Column Must Be Filled In” appears.	The error message “Column Must Be Filled In” appears.	Pass
4	User registration with valid data	The account was successfully created and the message "Registration Successful" appears.	The account was successfully created and the message "Registration Successful" appears.	Pass
5	User registration with duplicate data	The error message "Email Already Registered" appears.	The error message "Email Already Registered" appears.	Pass
6	The registration user did not fill in one of the columns	The error message “Column Must Be Filled In” appears.	The error message “Column Must Be Filled In” appears.	Pass
7	Fill in your email on the forgotten password page	The system sends a link to change the password	The system sends a link to your email to change your password	Pass

Table 3 outlines testing scenarios conducted to evaluate features accessible to users with the Super Admin role. Each scenario examines actions taken by the Super Admin, such as changing member roles and reviewing user-submitted bug reports. The test results indicate that the system displays messages and information as expected, ensuring these features function effectively and support optimal system management.

Table 3: Testing Scenarios Role Super admin

No	Test Case	Expected Results	Test Result	Information
1	Super admin changes the role of members to management or management to members.	Displays the success message "User Role Changed Successfully"	A message is displayed on the super admin page "User Role Changed Successfully"	Pass
2	Super admin opens user-submitted bug reports.	Bug report details appear with complete information, namely the bug title and bug description.	The system displays bug report information based on the bug title and bug description.	Pass

Table 4 presents testing scenarios designed to evaluate the functionality available to users with the Management role. Each scenario assesses specific actions, such as uploading materials, managing quizzes, joining group chats, and updating personal information, with expected outcomes validating that each feature performs as intended. The test results confirm that the system consistently provides accurate feedback and supports the Management role's operational tasks efficiently, ensuring a user-friendly and reliable experience.

Table 4: Testing Scenarios Role Management

No	Test Case	Expected Results	Test Result	Information
1	Management upload materials	The material has been successfully uploaded and appears in the material list and the message "Material Added" appears.	The material has been successfully uploaded and appears in the material list and the message "Material Added" appears.	Pass
2	Management uploads materials without filling out the form	The error message "Please fill in the entire form" appears.	The error message "Please fill in the entire form" appears.	Pass
3	Delete the material as	The material was successfully deleted	The material was successfully deleted and	Pass

	selected	and the message “Deleted Material”	the message “Deleted Material	
4	The management updated the material.	The material has been successfully changed and the message "Material Updated" appears.	The material has been successfully changed and the message "Material Updated" appears.	Pass
5	Management add quizzes with valid data.	The quiz has been successfully added, appears in the quiz list and the message "Quiz Added" appears.	The quiz has been successfully added, appears in the quiz list and the message "Quiz Added" appears.	Pass
6	The management did not fill out the entire quiz form	The error message "Please Fill in the Entire Form" appears.	The error message "Please Fill in the Entire Form" appears.	Pass
7	The management joins the KSPM group chat.	The management has successfully joined the chat group so he can send messages.	The management has successfully joined the chat group so he can send messages.	Pass
8	Management updated the profile photo	The profile photo has been successfully updated and the message “Photo Updated” appears.	The profile photo is updated on the screen and the message “Photo Updated” appears.	Pass
9	The management updates the password	Displays the message "Password updated successfully".	Displays the message "Password updated successfully"	Pass
10	Management report bugs	The bug report was sent successfully and displays the message "Report Sent"	The bug report was sent successfully and displays the message "Report Sent"	Pass
11	The management logs out of the application.	The management successfully logs out and is directed to the login page.	The management successfully logs out and is directed to the login page.	Pass

Table 5 details testing scenarios aimed at verifying the functionality available to users with the Member role. Each scenario covers essential actions, including downloading materials, taking quizzes, joining group chats, and updating personal information, with expected outcomes that ensure a seamless user experience. The test results demonstrate that the system performs reliably, consistently displaying correct messages and facilitating efficient task completion for Members.

Table 5: Testing Scenarios Role Member

No	Test Case	Expected Results	Test Result	Information
1	Members download materials	The material is successfully downloaded to the device and the message "Download Successful" appears.	The material is successfully downloaded to the device and the message "Download Successful" appears.	Pass
2	Members take a quiz	The quiz is completed successfully and the score is displayed.	The quiz is completed successfully and the score is displayed.	Pass
3	Members do not fill in all the answers	The error message "Please fill in all answers" appears.	The error message "Please fill in all answers" appears.	Pass
4	Members join the KSPM group chat	Members have successfully joined the chat group so they can send messages	Members have successfully joined the chat group so they can send messages	Pass
5	Member updated profile photo	The profile photo has been successfully updated and the message “Photo Updated” appears.	The profile photo has been successfully updated and the message “Photo Updated” appears.	Pass
6	Member updates password	Displays the message "Password updated successfully".	Displays the message "Password updated successfully".	Pass
7	Members report bugs	The bug report was sent successfully and displays the message	The bug report was sent successfully and displays the message "Report	Pass

		"Report Sent"	Sent"	
8	Member logs out of the application	The member successfully logs out and is directed to the login page.	The member successfully logs out and is directed to the login page	Pass

DISCUSSION

The mobile application developed for the Capital Market Study Group at Universitas Teknologi Yogyakarta (KSPM UTY) features three main user roles: members, management, and super admin (Faudzi et al., 2024). Each role is designed with specific features that align with their needs and responsibilities in the learning process:

1. Members can access learning materials that are organized in an easy-to-read and understandable format. Additionally, they can take quizzes designed to assess their comprehension of the material. The group discussion feature also allows members to interact and discuss the studied topics, enhancing engagement and collaboration among members.
2. Management has the authority to manage learning content, including adding, editing, or deleting available materials. They can also create new quizzes and monitor the results of quizzes taken by members. This feature enables management to ensure that the content presented is always relevant and up-to-date.
3. Super admin fully controls the application, including user management and access settings. They are also responsible for monitoring bug reports and making necessary corrections, ensuring the application operates effectively and provides an optimal user experience.

In Figure 4 below, the login, registration, and password recovery interface is displayed. This page is designed with a simple and intuitive layout to enable users to easily authenticate themselves for application access. The login and registration forms consist of email and password inputs, along with buttons for signing in or registering. There is also a "Forgot Password" feature that assists users in recovering their accounts in case they encounter issues with their password.

Figure 4: User Interface Page Login, Register, Forget Password

Next, Figure 5 presents the main and bug report page interface, specifically accessible to the super admin. This page allows the super admin to monitor application performance and manage any bug reports that may arise, thereby maintaining optimal application quality. Through this interface, the super admin can quickly review, track, and address issues reported by users, ensuring a timely resolution process.

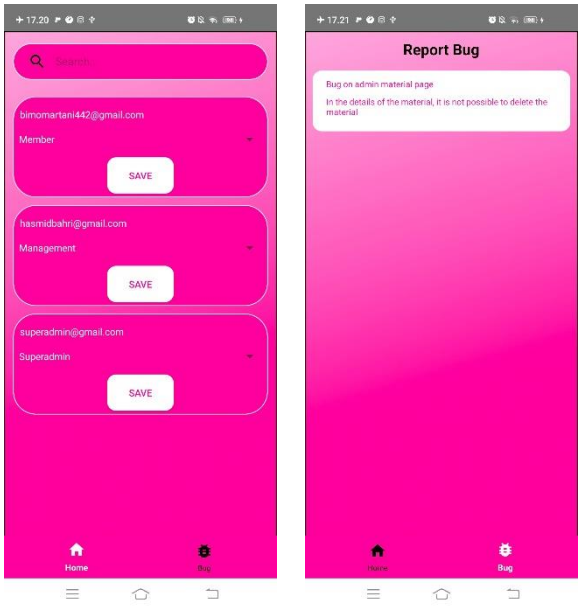


Figure 5: User Interface Page Home, Bug Report (Role Super admin)

Figure 6 showcases the member interface, which includes the main page, material detail page, quiz selection, and the interface for answering quiz questions. This layout is tailored for members to easily access materials, choose quizzes, and engage with available quizzes to support interactive and engaging learning. The interface is designed to provide a streamlined and intuitive user experience, enabling members to focus on learning without unnecessary distractions.

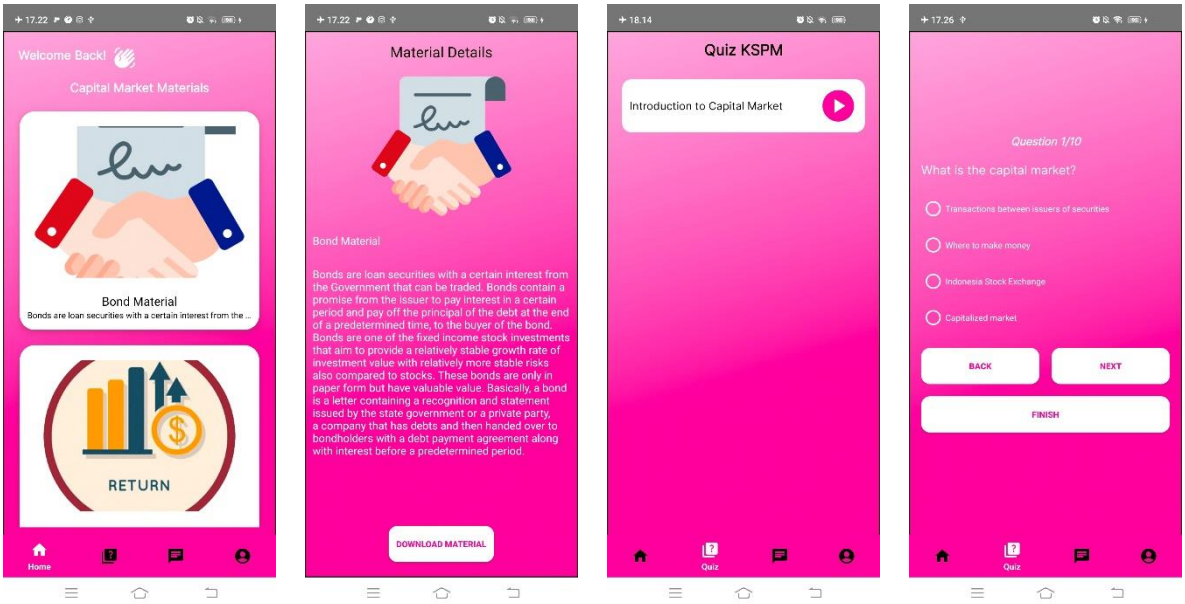


Figure 6: User Interface Page Home, Material Detail, Quiz, Answer Quiz (Role Member)

Then, Figure 7 displays the main page, the add material page, and the manage materials page, enabling management to add, delete, or modify content. Additionally, there is a quiz creation page where management can design new quizzes for members. This interface allows management to efficiently oversee and update educational resources, ensuring that members have access to relevant and up-to-date materials and quizzes.

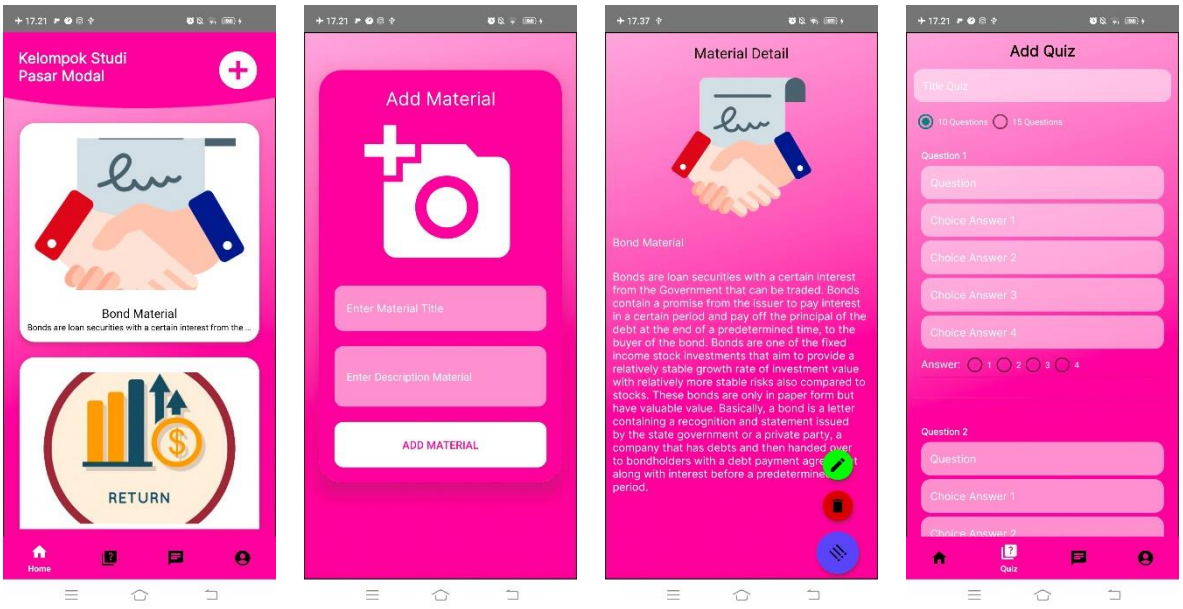


Figure 7: User Interface Page Home, Add Material, Manage Material, Add Quiz (Role Management)

Finally, Figure 8 presents the group chat join page, chat content, user profile, and bug report page. This interface applies to both members and management due to its similar layout, providing a consistent experience for communication within the group, accessing profiles, and reporting bugs encountered during application use. The cohesive design across user roles fosters a unified experience and provide feedback efficiently.

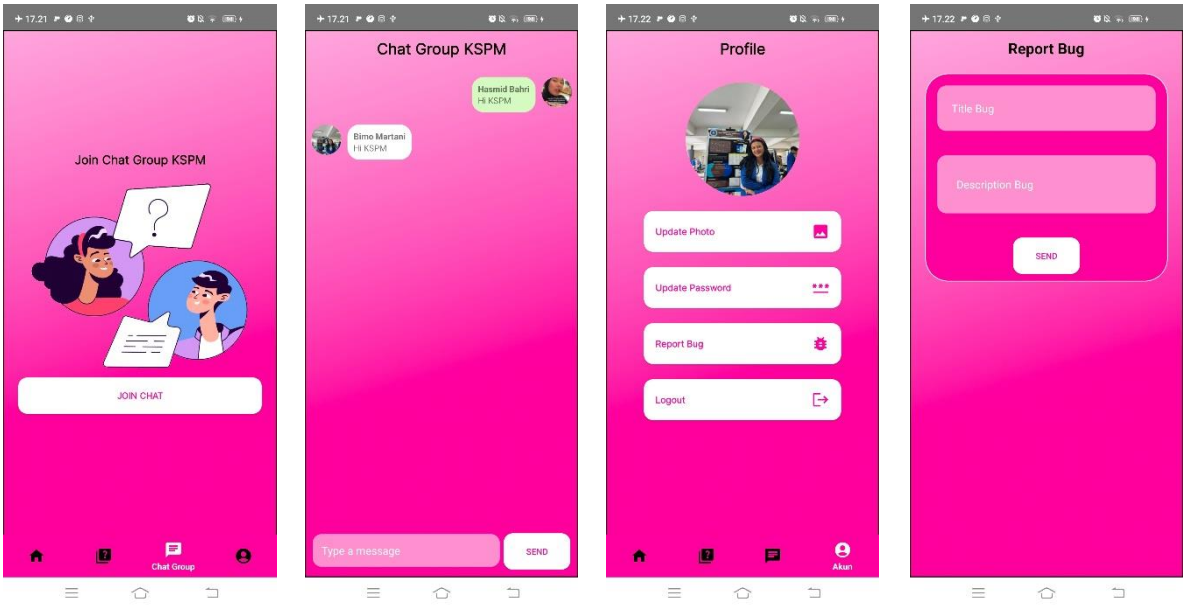


Figure 8: User Interface Page Join Chat, Chat Group Content, Profile Users, Report Bug

CONCLUSION

Based on the findings and analyses, the developed mobile application has proven effective in addressing the educational needs of KSPM UTY members for capital market learning. The application provides structured and accessible learning resources, including downloadable materials, interactive quizzes, and group chat functionalities that support collaborative learning. By implementing Firebase for real-time data management, the system ensures reliability and a seamless user experience across all functionalities. This structured approach allows for role-based access, ensuring that members, management, and super admins can efficiently interact with the application according to their specific responsibilities.

In addition, the study highlights the importance of understanding user requirements through initial interviews and observations, which guided the design and functionality of the application. The inclusion of role management, content management, and bug reporting features further supports the application's maintainability and adaptability to user needs. Overall, the development of this mobile application represents a significant advancement in digital learning tools, offering a practical solution for improving capital market education within KSPM UTY.

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