Enhancing Financial Literacy in Higher Education: Leveraging Mobile Data Visualization Techniques for Computer Science Student

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ABSTRACT

University students frequently encounter difficulties in successfully managing their funds, leading to financial stress, debt, and poor financial decisions. This project employs data visualisation techniques to educate university students on effective financial management, addressing common challenges such as financial stress and poor decision-making resulting from limited resources and the absence of personalised planning tools. The application simplifies intricate financial data through intuitive visualisations, enabling students to make well-informed choices. The project adheres to the Waterfall Model, progressing through distinct phases of planning, design, development, testing, and deployment. The importance of this rests in promoting healthy financial behaviours, alleviating anxiety, and enhancing students' abilities in managing their finances. The research aims to enhance students' understanding of financial planning by leveraging visualisation techniques. The apps were validated via usability testing and quantitatively analysed a sample of 30 Computer Science students at UiTM Tapah. Respondents confirm that the application is capable of assisting them in comprehending and managing their financial circumstances. However, the application is currently only available to university students and is dependent on Android and internet connectivity. Possible future improvements could include integrating artificial intelligence for expense prediction and expanding to iOS for improved accessibility, with the goal of reaching a wider range of user demographics.

Keyword: data visualization, educate finance planning, financial planner apps

INTRODUCTION

University students often exhibit a lack of financial knowledge, impacting their financial behaviors and decision-making processes. Studies show that while students may have a satisfactory understanding of financial concepts, there is a notable gap between their theoretical knowledge and practical application [1]. This lack of financial literacy can lead to financial problems, especially due to insufficient savings [2]. Enhancing financial education is crucial to bridge this gap and empower students to make informed financial decisions, eventually contributing to their long-term financial stability [1].

Thus, our research aims to provide crucial financial planning knowledge and skills to university students, recognising the typical challenges they face when managing their finances with limited resources. Using budgeting tools, students establish spending limits for different consumption categories, enabling them to track expenses and make necessary adjustments if budgets are exceeded or underutilised.

Research indicates that financial education positively influences subsequent financial behaviour, underscoring the importance of financial planning for students [1]. By integrating data visualisation into a financial planner app, the project aims to enhance students' financial planning capabilities, address usability concerns identified in existing apps, and tailor the solution specifically to the needs of university students [2]. This innovation helps students understand the process of monitoring their expenses and making prudent financial choices, allowing them to effectively manage their sound financial resources.

Researchers emphasised the need to provide young adults, particularly those in higher education, with comprehensive instruction in financial literacy and management. Financial literacy is an essential ability that young adults must possess in order to effectively manage their finances and make well-informed decisions, as stated by Lusardi [3]. This knowledge not only assists individuals in navigating present financial difficulties but also equips them for forthcoming financial obligations.

LITERATURE REVIEW

Financial Literacy in Higher Education

Financial literacy among higher education students is a significant global concern, as indicated by studies conducted in Portugal, China, the United States, Indonesia, and Russia which have provided insights into many aspects of this issue. A study conducted in Portugal emphasises the strong correlation between financial literacy, resilience, and financial well-being among university students [4]. In China, gender and family background significantly impact financial literacy levels among higher vocational college students, suggesting the need for tailored educational approaches [5]. In the United States, financial stress is a leading cause of anxiety and depression among college students, underscoring the importance of financial self-care and effective money management skills [6]. A study conducted in Indonesia emphasises the impact of financial education throughout college on the financial literacy levels of students, indicating the necessity for specific educational interventions [1]. Similarly, research conducted in Russia has shown that students have a low perception of their own financial literacy. This highlights the need for teaching methods that focus on practical skills to improve financial understanding during university education [7]. Therefore, this innovation was developed as a digital solution to enhance financial literacy among students in higher education.

A Healthy Financial

The overall welfare of higher education students is contingent upon their financial well-being. Studies have shown that financial education programmes executed in higher education institutions are crucial for enhancing students' understanding and knowledge of financial issues [8], particularly in areas like saving and credit management [3]. However, the issue of financial difficulty among students continues to be widespread, stemming from factors such as limited financial resources, societal pressures, and familial situations [9]. In order to effectively meet students' needs and improve their long-term financial security, universities must regularly evaluate and improve their financial education programmes [10][1].

Factors influencing financial literacy and financial management

Multiple factors influence higher education students' financial literacy and financial management. Financial

knowledge, financial attitudes, and financial culture are influential factors that shape students' financial behavior, ultimately impacting their level of financial literacy [4]. Furthermore, research has shown that the influence of parents and peers, as well as the inclusion of financial education in educational institutions, positively affects the financial literacy and financial management skills of young individuals [10]. Additionally, demographic variables such as age, gender, educational attainment, and income contribute to the overall financial literacy level of college students. There is a positive correlation between financial literacy and measures of resilience and financial well-being [4]. These findings highlight the importance of adopting a comprehensive strategy to financial education and management among students in higher education. It underscores the significance of implementing comprehensive initiatives to improve their levels of financial literacy.

Relevance of Mobile Data Visualization

Mobile data visualization plays a crucial role in enhancing finance literacy by providing easy access to financial information and facilitating efficient decision-making [11]. According to the study by [12], the integration of mobile applications in financial education allows individuals to enhance their knowledge and understanding of financial matters. Additionally, the research conducted by [13] introduces the IoT-based Efficient Data Visualisation Framework (IoT-EDVF), which highlights the significance of data visualisation in corporate finance. This framework facilitates more accurate risk analysis, better assessment of revenue, and improved management of data quality. By leveraging mobile devices for data visualisation, individuals can acquire significant insights into financial data, thereby enhancing their financial literacy and decision-making capabilities.

METHODOLOGY

The project employed the Waterfall model, which is a systematic and organised approach to application development. It provides precise milestones and clearly defined outcomes. The process consists of several steps, namely original needs planning, development, testing, and deployment [14].

Planning

The planning phase is crucial in the development of a data visualisation for a student financial planner as it establishes the core principles necessary for successful and efficient execution. The document includes most of the project prerequisites for addressing the problem statement, defining the scope, and accomplishing the initial project objectives. A comprehensive application architecture has been established, encompassing the specific technology prerequisites and modules that were utilised. Further details will be provided in the following section.

Application Architecture

The application architecture of the mobile solution, "Student Financial Planner," begins with a secure login process in which users provide their email and password. The front end consists of six modules: user profile, dashboard, spending, transactions, analytics, and savings. Each module interacts with a cloud storage system. These modules initiate calls to the Firebase database, which is a cloud-based solution that allows for real-time data retrieval and storage. The obtained information undergoes a data visualisation process using specific methodologies to enhance comprehension. The completed visualised data is displayed to end users, guaranteeing a comprehensive and user-friendly interface for efficient financial planning. Figure 2.1 presents the application architecture for this project.
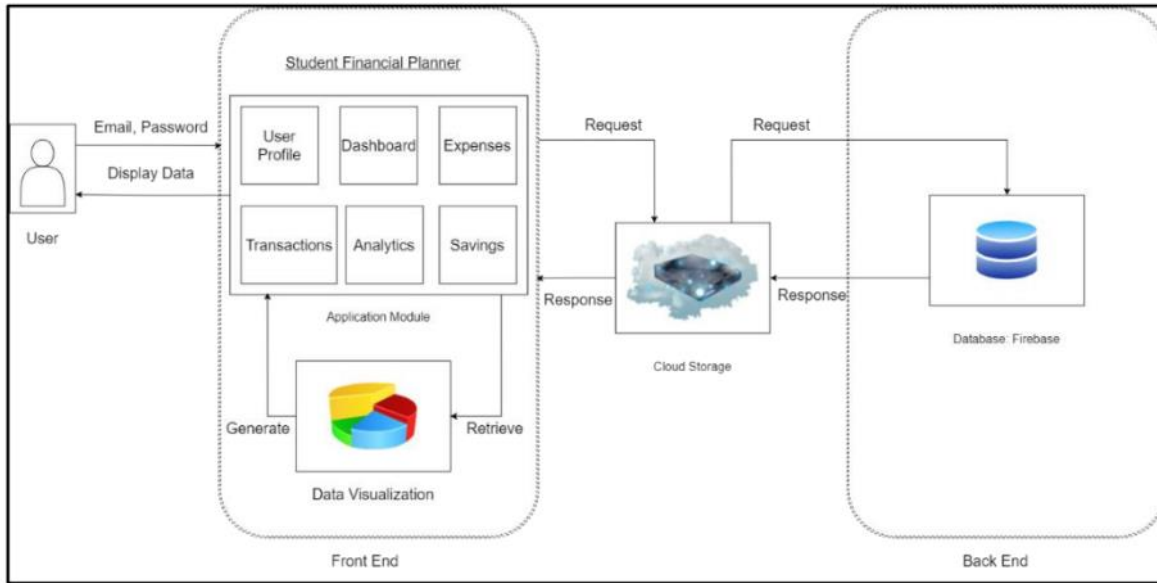
Figure 2.1 Application architecture.

Development

The technical implementation of data visualisation in a financial application is a crucial step in the project development process. It involves designing data visualisation for the Student Financial Planner application and utilising programming languages and frameworks that are suitable for developing data visualization. This phase focuses on converting the design specification into functional code. A key aspect of this phase is the production of data using the chosen data visualisation technique. The researchers conduct extensive internal testing and debugging to ensure that the data visualisation for Student Financial Planner operates accurately and effectively in managing user interactions. During the development process, it is important to adhere to application development best practices and coding standards to ensure that the Student Financial Planner application is modular, scalable, and maintainable. Figure 2.2 shows the dashboard design, which used visualisation techniques to accommodate students and help them understand their financial status.

Figure 2.2: Dashboard Design of Student Financial Planner

Testing

A group of 30 university students in the Degree of Computer Science at UiTM Tapah Campus evaluated the application via face-to-face interactions. A pilot study can effectively evaluate the feasibility, acceptability, and possible benefits of an intervention among a manageable group of participants. For this purpose, a sample size of 30 is considered sufficient [15].

The testing method enables the collection of valuable feedback and insights from targeted users, aiding in the identification of usability problems, areas for enhancement, or features that need refinement. Initially, the researchers sent an email to potential participants. Next, the researchers arrange an appointment with participants who have given their consent, taking into account their preferred date and time. The testing session allowed participants ample time to install and utilise the application on their smartphones. Once the participants have explored the application, the researchers ask them to complete a Google Forms-generated questionnaire. The questionnaire findings were assessed quantitatively by visualising the data using a suitable chart in Microsoft Excel. Figure 2.3 illustrates the complete testing procedure.
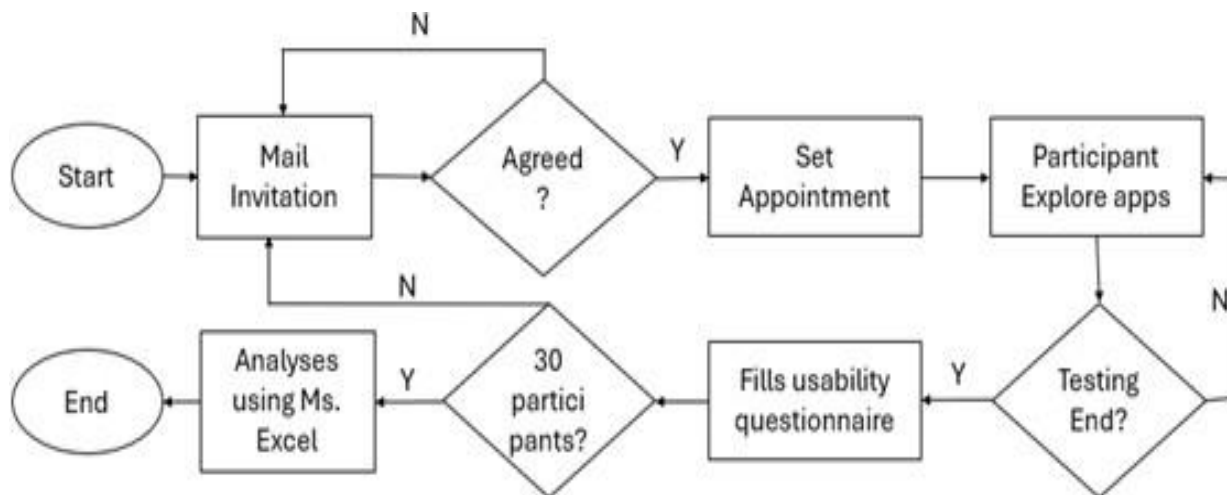

Figure 2.3: Testing procedure.

Deployment

The deployment phase is the stage at which the data visualisation technique is completely ready and available for students to assess and explore. This phase encompasses a range of tasks aimed at ensuring a successful deployment. Initially, the project team established the necessary infrastructure to host the Student Financial Planner. The code and resources for the Student Financial Planner are then disseminated on an Android smart device to facilitate the simulation of real-life testing.

RESULT AND DISCUSSION

A quantitative evaluation was conducted to evaluate the overall usability satisfactory of data visualisations among participants for the Student Financial Planner. The feedback was adequate in terms of overall design and usability (rated on a scale of 1 to 10). Figure 4.1 illustrates the distribution of satisfaction ratings on a scale of 1 to 10. It is important to note that the majority of participants rated their satisfaction on the high end of the scale. Twelve participants chose a satisfaction level of 9 and 10, respectively, followed by four participants who rated it at 8, and one participant who gave ratings of 7 and 6.
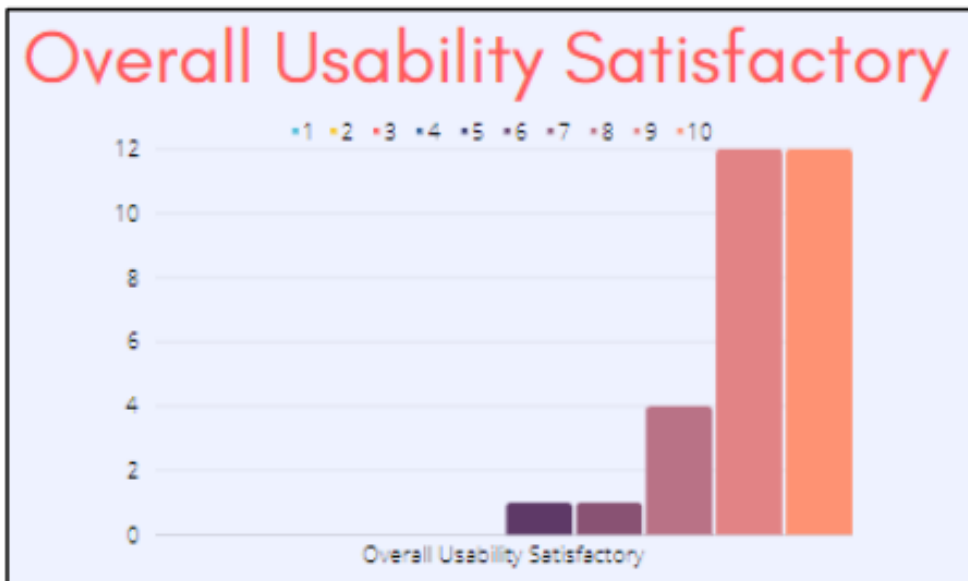
Figure 4.1 Result of overall usability satisfactory.

Based on the overall high satisfaction ratings, it is evident that the Student Financial Planner's data visualisations were well-received by the target demographic. Ratings concentrated at the upper end of the scale indicate that the application's usability meets or exceeds the expectations of the majority of users. The application's positive response is crucial for its performance and user retention. This result is valuable to the research because it determines end users' success and acceptance of the product [16]. However, the presence of lower ratings highlights the possibility for further refinement [17].

Additionally, the Student Financial Planner's data visualisations undergo an analysis to determine their overall design satisfaction. In usability testing, design satisfaction is defined as the level of user contentment achieved through effective and efficient interface design [18]. Figure 4.2 depicts the evaluations provided by the participants, with a substantial majority indicating high levels of satisfaction. More precisely, 18 participants gave their satisfaction a perfect score of 10, while 7 participants gave it a 9, 3 participants gave it an 8, and 1 participant gave it a 7 and 6, respectively.
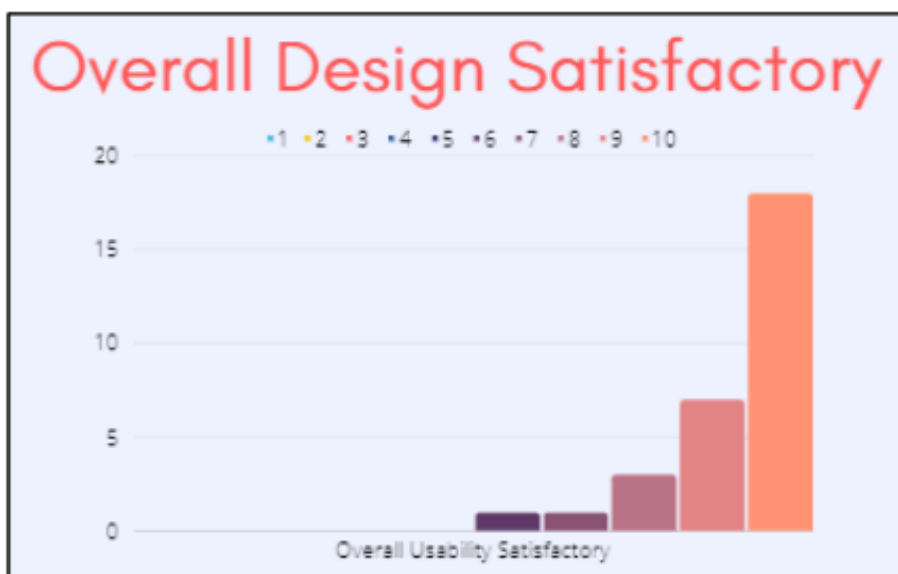
Figure 4.2: Result of overall design satisfactory.

The overwhelmingly positive ratings for overall design satisfaction indicate the application's success in effectively conveying financial information to the user through the visualisation features. The high scores suggest that the design components resonate well with the user base, which is crucial for an engaging user experience and understanding [12], [19]. However, the few lower scores claimed that that their satisfaction is natural due to the fact that the design is enough for their needs, despite the predominantly favourable results. The participant proposes enhancing the button's design by incorporating a more advanced level of interactivity. Usability testing has been demonstrated to enable researchers to identify the strength and weakness of a design [17][21]. The researcher integrates the suggestions as input for future improvements.

Enjoyable features in usability testing include focusing on emotional experiences while using an application or software [22]. In this study, the pie chart in Figure 4.3 illustrates the outcome in terms of features that are both enjoyable and beneficial to the participants. 'Set Savings' emerged as the most appreciated feature, with 27.6% of participants citing it as a standout. The 'Progress Bar' also received significant praise, accounting for 20.7% of the preference share. Users also favoured other features such as 'Insert Income', 'Insert Expenses', 'Pie Chart', and 'Bar Chart', with each garnering around 10-14% of their preference.
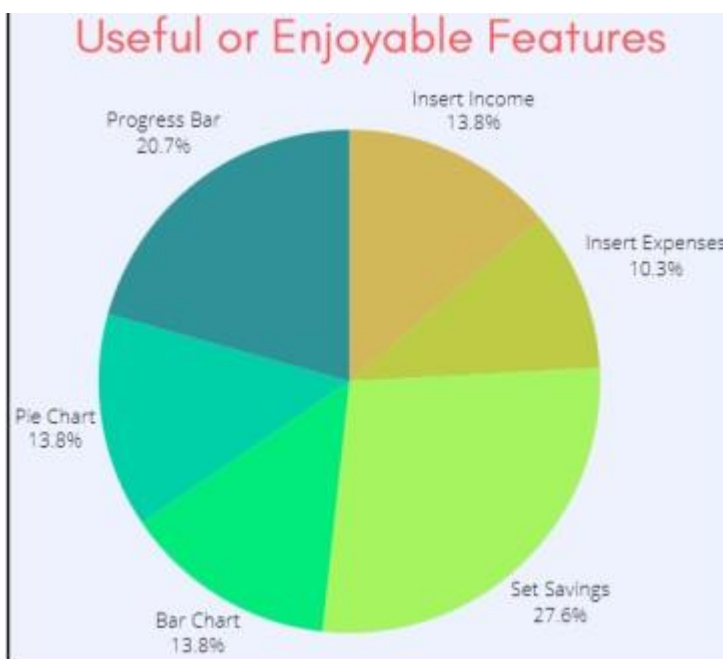
Figure 4.3 Result of overall useful enjoyable features.

The analysis of user preferences for the application's features reveals a significant preference for savings features, particularly 'Set Savings' and 'Progress Bar'. This implies that users are looking for not only tools to monitor their financial activities, but also elements that aid in financial strategizing and objective establishment. Although users value the core features related to income and expenses, there is a distinct demand for additional strategic financial management tools. Enhancing these aspects and introducing new features that support financial growth and literacy could further increase user satisfaction and engagement. Enjoyment is a strong determinant of long-term usage intentions for apps, making it a valuable indication [23].

CONCLUSION

The survey participants expressed enthusiastic acclaim for the Student Financial Planner application, consistently lauding it as "excellent and highly informative." The users praised the application for its user-

friendly and intuitive interface, emphasising its efficient functionality without superfluous intricacies. Thus, we can infer that the Student's Financial Planner project utilises an effective visualisation technique to assist students in understanding financial planning. A visualisation tool has been employed to aid students in maintaining a healthy financial routine. Nevertheless, the application may necessitate some enhancements. The participants suggested incorporating additional interactive buttons within the application. In addition, the application exclusively concentrates on the development and testing of the Android platform, requiring a reliable Internet connection for optimal performance. Potential future advancements could be the incorporation of artificial intelligence in forecasting expenditures and the extension to iOS to enhance accessibility.

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