Journal of Artificial Intelligence and Engineering Applications

Website: https://ioinformatic.org/

15th June 2024. Vol. 3. No. 3; e-ISSN: 2808-4519

Designing UI/UX for Mobile Learning on Programming Language Material Using the Design Thinking

Faradina Anggraeni Ma'roef[1], Prita Dellia[2], Moh. Arif Hidayatullah[3], Siti Rosyidah[4], Ririn Setyaningrum[5*], Shofiyulloh Somat[6]

[1,2,3,4,5,6] *Program Studi Pendidikan Informatika, Universitas Trunojoyo Madura, Jl. Raya Telang, Perumahan Telang*
faradinamaroef@gmail.com , prita.dellia@trunojoyo.ac.id[2], moharifhidayatullah1@gmail.com[3] , rosidah605@gmail.com[4], ririnalvio123@gmail.com[5], pandawasofi@gmail.com[6]*

Abstract

The rapid advancement of technology in the Industry 4.0 revolution has driven organizations to adapt through digital transformation, including in the field of education, allowing for more efficient and effective learning processes in line with the needs of society5.0. This article discusses the UI/UX design of a mobile learning application for programming language material using the Design Thinking method, which includes five stages: Empathize, Define, Ideate, Prototype, and Testing, with a focus on user understanding and needs. The design process involves creating prototypes and testing to ensure a user-friendly design. The main features of the application include a splash screen, welcome page, login and sign-up pages, home page, material pages, notes, user profile, and an Executor feature for writing and running code directly. Testing results using the System Usability Scale (SUS) showed an average score of 65, falling into the "adequate" category, indicating that the design functions well. However, further research is needed to refine this application, highlighting the importance of a structured and user-focused approach in designing digital educational applications.

Keywords: *Design Development, UI/UX, Learning Management System, Design Thinking*

1. Introduction

Rapid technological advances have had a major impact on the industrial revolution 4.0, which encourages organizations to adapt to changes in the digital era in various fields [1]. Organizations that adopt digital technologies supported by new Information and Communication Technologies (ICT), known as digital transformation, open up significant growth opportunities. Digital transformation has changed the world on a large scale, creating more effective and efficient methods to replace old processes in various activities by utilizing existing technology. Everything, from daily activities to financial transactions, can now be managed more easily thanks to digital transformation. Considering that the industrial revolution 4.0 influences people's lifestyles, the concept of society 5.0 emerged as a technology-based and human-oriented society [2]. Therefore, it is very important for people to have digital skills and be able to use modern technology, which can only be achieved by incorporating digital technological transformation into education.

There has been significant progress in the field of education thanks to technology and digital information that has occurred in the last few decades [3]. Education is one of the sectors that has succeeded in achieving industrial revolution 4.0 through the application of technology that drives digital transformation. The education sector is experiencing digital transformation by applying technology that brings major changes to society, business, the economy and other social environments [4]. Digital transformation aims to better understand the needs and behavior of stakeholders, as well as adapt education and social services to suit the needs of society 5.0 in a competitive environment[5].

Education plays a very important role in shaping the future of individuals and society [6]. In Indonesia, education plays a crucial role, but the main problem is rooted in the broader societal context. Along with advances in science and technology, various aspects of society develop, and education undergoes significant changes to achieve its goals and developments [7]. One tool that can be used in the classroom learning process is the internet [8]. Initially used for communication, the internet is now also used for learning and educational activities.

In designing a product and design, appropriate methods are needed, so that the resulting design is fully user-oriented and in accordance with the user's needs and desires. According to Ford, design thinking is the right method for solving a problem by focusing on the user (user oriented). Application design is not as easy as turning the palm of your hand. Effective and efficient applications must be designed

by paying attention to user needs in detail. Therefore, user interface (UI/UX) design plays a very important role in ensuring digital applications can provide a satisfying user experience [9].

It is hoped that the UI/UX Mobile Learning design will make it easier and support teachers in controlling students and reduce the decline in students' enthusiasm for learning by designing the features needed by users. UI/UX design can be done using various methods. In this research, the method used is the Design Thinking method. The reason for using the design thinking method is that this method applies a systematic approach to the user in the phase of empathizing with the user's problems and needs, there is an iterative design that is repeated when an inappropriate design occurs, and many solution ideas are developed because it emphasizes a person's various innovative ideas [9].

UI/UX design is the process of creating and designing digital products such as websites, mobile applications and software by focusing on user experience and user interaction with the product or user interface [10]. UI/UX design is created with the aim of communicating the available system features so that users understand and can use the system, and has satisfaction and comfort values when users use the application [11].

A mobile application (mobile apps) is a program that is run on a device such as a smartphone, laptop or PC, to help users carry out activities more easily and flexibly. Mobile apps have the ability to perform local processing, collect, analyze, and format information in a way that is suitable for the mobile platform. According to Pressman and Maxim (2014), mobile apps are applications specifically designed for mobile platforms with operating systems such as iOS or Android.

Mobile learning apps are a form of multimedia device for learning content [12]. Multimedia has a lot of good potential in representing and delivering learning material. Currently, there are many popular parenting applications that can help parents learn about parenting, but generally these applications only focus on parents, are informative, less interactive, less fun, and do not involve parent-child interaction.

Programming language is usually called computer language or computer language programming, which is a standard instruction for controlling a computer. A set of syntax and semantic rules used to provide a definition to a computer program is known as a programming language. Using this programming language, a programmer can precisely determine the data to be processed by the computer, how it is stored and transferred, and what actions to take under various circumstances. Programming language is a way to give commands to a computer, application, telephone, or website to do something. Many educators and computer experts consider coding to be a "new language" that children can master from an early age.

Therefore, this research was conducted because of the urgent need to increase the effectiveness and efficiency of the learning process in the digital era, especially in teaching programming languages. The industrial revolution 4.0 and the concept of society 5.0 have changed the educational paradigm, requiring technological adaptations that not only facilitate but also enrich the learning experience. The use of the Design Thinking method in designing mobile learning UI/UX was chosen because this approach focuses on the user, ensuring that the application developed truly meets their needs and preferences. Thus, this research aims to overcome challenges in digital education, create interactive, informative and fun learning tools, and support the development of essential digital skills among students.

2. Research Methods

Design Thinking is a collaborative method that collects many ideas from scientific disciplines to find the most effective and efficient solution to solve a complex problem that not only focuses on what is seen and felt, but also focuses on the user experience. Design thinking is an idea designed by Brown and Wyatt, where this idea produces effective solutions according to user needs. A method called design thinking is used to solve problems creatively and effectively, with the main focus on the user. The design thinking method can generate many ideas and develop innovative solutions by demonstrating designs through testing and prototypes. It's an approach about understanding deeply, defining problems in an inspiring way, and creating innovative solutions. In the design thinking concept proposed by Tim Brown, there are five main stage:

1. Empathize
   At this stage, Emphatize focuses primarily on understanding users in depth. Tim Brown proposes that we listen to users, observe users, and empathize with users. This helps us to feel and understand user needs, expectations and challenges. Emphatize aims to develop knowledge about what users do, say, think and feel. Emphatize is used to gather enough information so that researchers can begin to empathize with the user's perspective. At the empathize stage, it is also important to understand user needs, business goals, and technological capacity and capabilities. The next step after receiving the information is to create an empathy map as in Figure

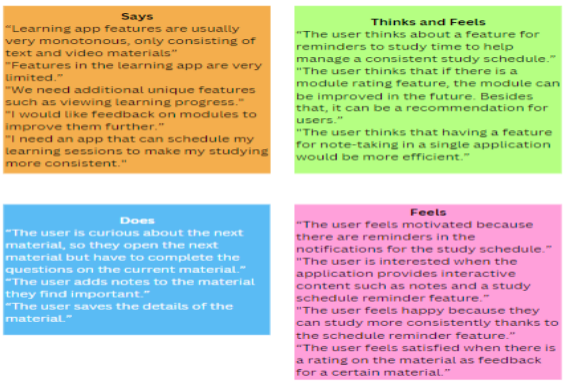

Fig. 1: Emphaty Map

2. Define
   After gaining an in-depth understanding of the user, the next step is to reformulate the problem in a more inspiring and focused way by grouping it back into the same categories by creating user personas that result in user frustration or problems that users face when using the learning management system and the goals that users want in designing a learning management system application. The purpose of a user persona is 8 to pinpoint user needs. The user persona is displayed in the form of results in Figure 2

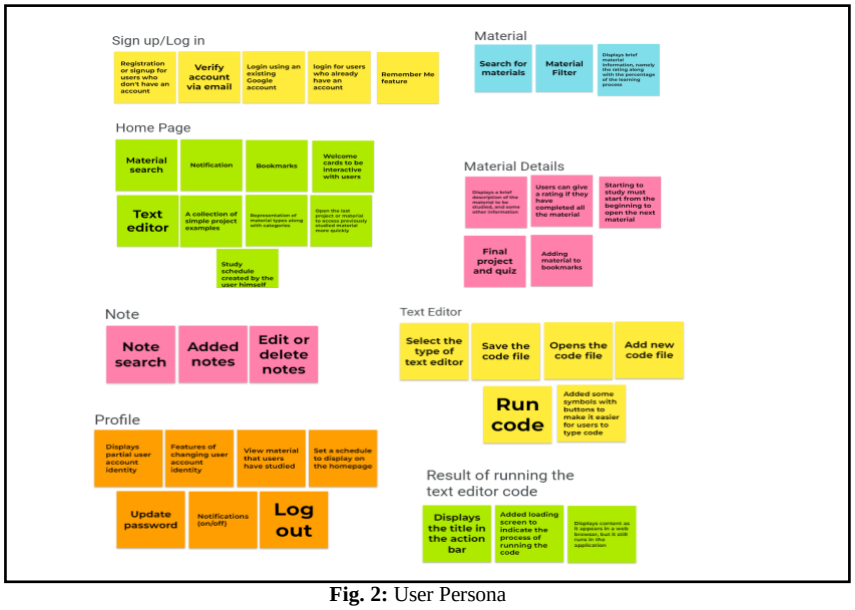

Fig. 2: User Persona

3. Ideate
   The ideation stage involves the generation of a variety of creative solution ideas. Tim Brown encourages thinking "outside the box" and avoiding premature judgment. Brainstorming and other lateral thinking techniques are used to generate as many ideas as possible. Then the ideas are grouped based on existing themes or the same category. In the previous stage, there was a user persona with user goals or needs. At this stage, these needs can be grouped into 12 required application features.
4. Prototyping
   Prototyping involves creating simple models or visual representations of ideas generated in previous stages. This prototype helps in conceptualizing the idea in a more concrete way and provides something that can be tested with users. Wireframes are created starting from sketches to detailed representations of the final design followed by high fidelity.
5. Testing
   The prototype is tested with users to get feedback. This stage helps the team to understand what is working and what needs to be improved in the proposed solution

3. Results and Discussion

3.1. High Fidelity Design Results

The step that must be completed first is the UX Research stage using the design thinking method with a sequential process, namely empathize, define, and ideate. The next process is to integrate user needs into a high fidelity design. The results of the product design that have been made are attached in Figure 6.

Figure 6 includes the splash screen or initial display that appears when the application is launched before displaying the main content of the application which is useful for users to recognize the application by displaying the logo or identity of an application. After that, the user will be directed to the welcome page. This page contains a brief explanation of the application as well as login and signup buttons.

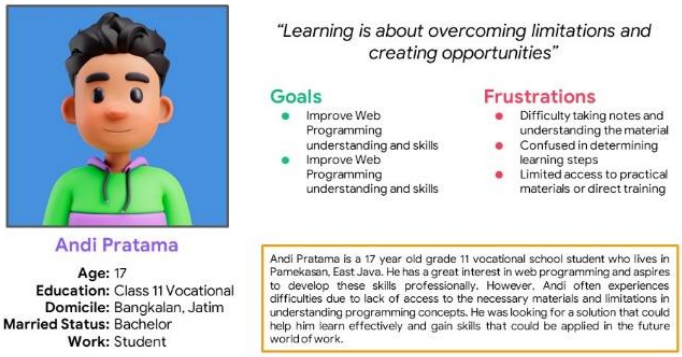

Fig. 3: Affinity Diagram

Each button will redirect to a new page again. The SignUp page contains username, email and password data, but users can register with their Google account. Meanwhile, on the login page, users only enter the registered username and password.

The initial page that appears after the user successfully logs in is the Home Page. This page contains greetings to users, programming language categories complete with titles, images, learning progress, amount of material in that category, and ratings. This page displays recent courses or material that was most recently opened, with the aim of making it easier for users to quickly access the most recently studied material. In addition, the study schedule set by the user appears on this page. The goal is for users to remain consistent in learning. The important point in mobile learning is the material. The next page is a material page which contains more material collections than the home page. This page contains complete programming language material. Category selection is also displayed in detail compared to the home page. Another supporting feature is notes. The third page in this application is notes. Notes that users add to note important things. Just like when we study at school, we need books or notes to support our learning. So this application provides a notes feature to support mobile-based learning. The developer didn't forget to add an add note page so that users can add the notes they want to add. The last page is the user profile. On this page, users can find out learning progress in the form of a graphic number related to the amount of material studied, in progress, up to the material that has been studied. There are also other features such as profile settings, materials, setting a schedule which will later be displayed on the home page, updating passwords, notifications and logging out.

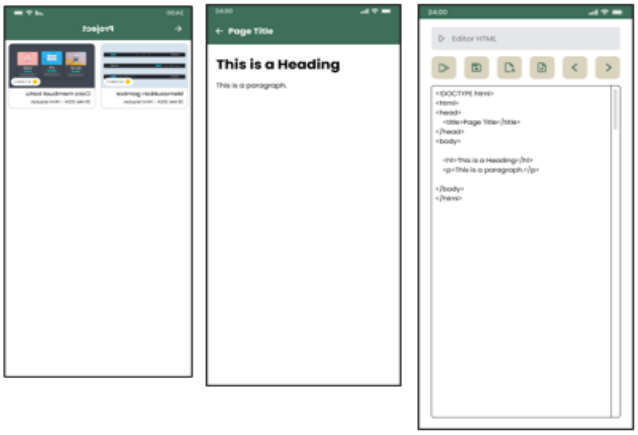

Fig. 3: High Fidelity Onboarding, User Login, Registration, Home, Account, Material, Material List, Material Details, Notes List, Adding Notes, and Account

Executor is a feature that allows users to add code directly and view the results without leaving the development environment. With this feature, users can write and run code quickly, speeding up the development and experimentation process. This is especially useful in situations where the user wants to test or test a small piece of code without having to create a new project or start a separate development environment. With Executor, users can quickly see the results of the code they write, helping in troubleshooting, new feature exploration, or just for quick experimentation. The design results are shown in Figure 5.

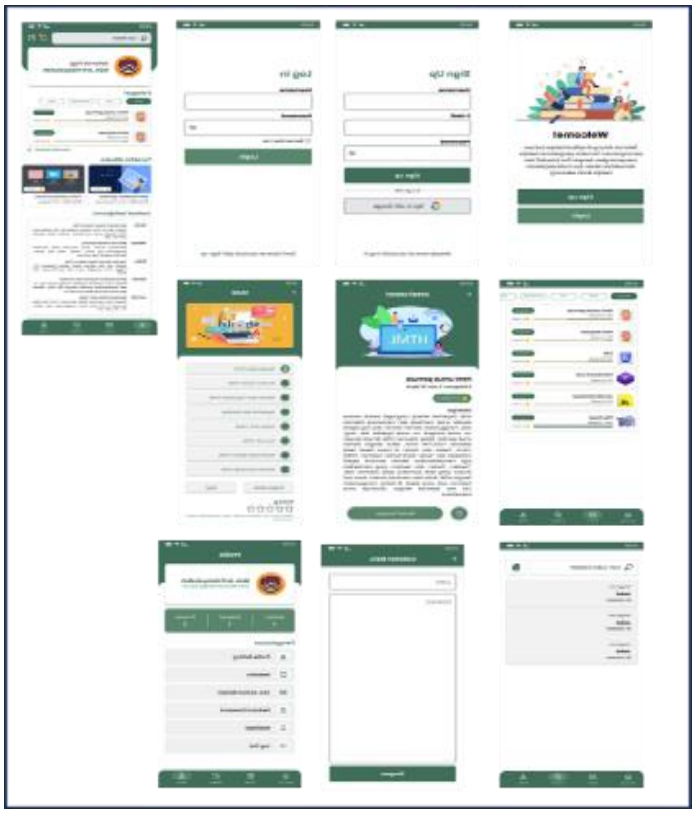

Fig. 5: High Fidelity Executor and coding result

3.2. Usability Testing Results

This Mobile Learning (M-Learning) application has undergone a prototype testing stage by applying the System Usability Scale (SUS) method which is useful for evaluating the level of system usability. This evaluation process includes three main stages, namely testing task scenarios, interviews, and distributing SUS questionnaires to collect the necessary data. In this context, the participation of ten interested users regarding mobile learning applications with the aim of ensuring comprehensive identification of all usability problems that may arise. The users involved in testing are general users who are interested in mobile learning. During the task scenario testing process, each participant was given ten tasks designed to evaluate various aspects of the LMS application. Details of the tasks undertaken by participants can be found in Table 1 below.

Table 1: Task Scenario for Mobile Learning Application

Code Task	Task	Scenario
T1	Reading the Mobile Learning app guide	Users read the guide before entering the app.
T2	Logging into the Mobile Learning app	Users are required to log in when they want to use mobile learning.
T3	Starting to learn through modules	Users select the module they want to study based on the available categories.
T4	Viewing the history of opened modules	After opening the module, users can see the last opened history on the home screen.
T5	Applying knowledge through projects	Users try the material obtained through the executor feature.
T6	Taking important notes	Users add notes containing important information during study.
T7	Giving ratings and reviews on modules	After studying the module, users can give a rating on the module they studied.
T8	Working on projects	After studying the material, users work on a project.
T9	Saving materials	Users can mark the material they like as favorite.
T10	Taking quizzes	Users can access quizzes after studying the material.

After participants complete testing, they will be asked to answer a series of questions in the SUS questionnaire. This questionnaire is designed to evaluate user perceptions of system usability in a structured and measurable way.

Table 2 presents a list of questions that will be asked to participants. Each question is designed to reveal a specific aspect of the user's experience of the Learning Management System (LMS) application being tested. Details of the questions contained in the questionnaire can be found in Table 2 below.

Table 2: SUS Questionnaire for Mobile Learning Application

No.	Questions	SD	D	N	A	SA
1.	I think I will use this app frequently again					
2.	I find this app difficult to use.					
3.	I find this app easy to use.					
4.	I need help from others to use this app.					
5.	I feel the features available in this app work as they should.					
6.	I feel there are many inconsistencies in this app.					
7.	I feel others will also quickly understand how to use this app.					
8.	I find this app confusing.					
9.	I find no obstacles when using this app.					
10.	I need to familiarize myself first before using the app.					

Note:
SD = Strongly Disagree
D = Disagree
N = Neutral
A = Agree
SA = Strongly Agree

Table 3: Final SUS Calculation Results

No.	Name	SUS Questionnaire										Total Score	Total SUS
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
1	Teguh Yulianto	4	3	5	3	5	2	4	2	5	4	29	72,5
2	Alvin kamil	3	3	4	2	4	3	4	2	5	2	28	70
3	Siti Juliah	5	3	5	4	5	4	5	3	5	4	27	67,5
4	Misfarah	5	4	5	4	4	4	4	4	4	4	22	55
5	Akmal Hasan	5	4	5	3	5	2	4	2	4	5	27	67,5
6	Whiky R.P	4	2	4	2	4	3	4	2	3	3	27	67,5
7	Raja	5	5	5	5	5	5	5	5	5	5	20	50
8	Camelia Savitri	5	4	5	4	5	5	5	1	5	3	28'	70
9	Riki Yakub	5	1	5	3	5	4	4	3	4	3	29	72,5
10	Imael	5	3	5	4	5	5	5	5	5	5	23	57,5
Average Score (Final SUS Result)													65

By referring to the information contained in the table above, the final average SUS score is 65, indicating that the assessment is in category D or Fair. This shows that all designs have operated properly. The following is an image of the corresponding SUS score scale.

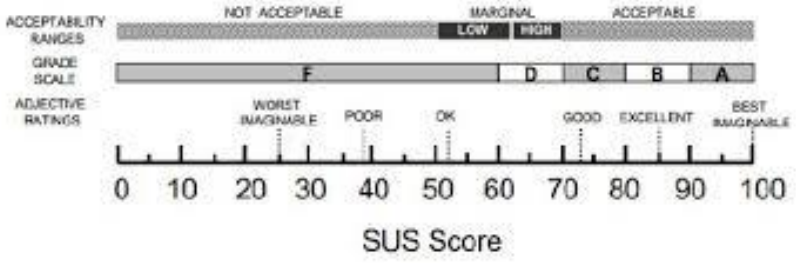

Fig. 4: SUS Score Scale

4. Conclusion

In designing the UI/UX for the Mobile Learning application, all designs have functioned well by addressing the issues that arose during the design process. The testing results using the System Usability Scale (SUS) method show an average score of 65, which falls into category C or Sufficient. This indicates that overall, the design has performed adequately. Based on this conclusion, further research is needed to refine the application development process.

References

[1] B. B. Al-Kansa, M. L. Iswanda, N. Kamilah, and Y. T. Herlambang, "Pengaruh Kemajuan Teknologi Terhadap Pola Hidup Manusia," *Indo-MathEdu Intellectuals J.*, vol. 4, no. 3, pp. 2966–2975, 2023, doi: 10.54373/imeij.v4i3.682.

[2] K. Resmi Hayati, I. Nugraha, F. Sholeha, A. Adriyanto, and R. L. Astutik, "Penerapan E-Business dan Teknologi Informasi dalam Revolusi Industri 5.0," *Waluyo Jatmiko Proceeding*, vol. 16, no. 1, pp. 401–410, 2023, doi: 10.33005/wj.v16i1.56.

[3] Putri Ayu Negara, Yuni Yulistianti, Elsit Julia Pratiwi, and Yusup Saeful bayan, "Pentingnya Pemanfaatan Teknologi Informasi Dalam Bidang Pendidikan Di Desa Mekar Asih," *J. Abdi Nusa*, vol. 3, no. 3, pp. 208–213, 2023, doi: 10.52005/abdinusa.v3i3.197.

[4] Muhammad Yusuf, Dwi Julianingsih, and Tarisya Ramadhani, "Transformasi Pendidikan Digital 5.0 melalui Integrasi Inovasi Ilmu Pengetahuan dan Teknologi," *J. MENTARI Manajemen, Pendidik. dan Teknol. Inf.*, vol. 2, no. 1, pp. 11–19, 2023, doi: 10.33050/mentari.v2i1.328.

[5] E. E. W. Tulungen, D. P. E. Saerang, and J. B. Maramis, "Transformasi Digital : Peran Kepemimpinan Digital," *J. EMBA J. Ris. Ekon. Manajemen, Bisnis dan Akunt.*, vol. 10, no. 2, pp. 1116–1123, 2022, doi: 10.35794/emba.v10i2.41399.

[6] F. Yustiasari Liriwati, "Transformasi Kurikulum; Kecerdasan Buatan untuk Membangun Pendidikan yang Relevan di Masa Depan," *J. IHSAN J. Pendidik. Islam*, vol. 1, no. 2, pp. 62–71, 2023, doi: 10.61104/ihsan.v1i2.61.

[7] M. Duman, M. S. Taat, and M. K. Abdullah, "Hubungan Kepemimpinan Instruksional Pengetua dengan Sikap Guru Terhadap Perubahan dalam Pendidikan Abad Ke-21," *Malaysian J. Soc. Sci. Humanit.*, vol. 6, no. 3, pp. 241–251, 2021, doi: 10.47405/mjssh.v6i3.722.

[8] I. Widiasanti, N. A. Ramadhan, M. Alfarizi, A. N. Fairus, A. W. Oktafiani, and D. Thahur, "Pemanfaatan Sarana Multimedia dan Media Internet sebagai Alat Pembelajaran yang Efektif," *Edukatif J. Ilmu Pendidik.*, vol. 5, no. 3, pp. 1355–1370, 2023, doi: 10.31004/edukatif.v5i3.4939.

[9] S. Nurmaharani and Heriyanto, "Analisa Dan Perancangan Ui/Ux Aplikasi Penjualan Menggunakan Metode Design Thinking Pada Cv. Multi Ban Oto Servis Bekasi Shally," vol. 9, no. 1, pp. 46–53, 2023.

[10] Z. Azziqra, "Perancangan UI/UX Untuk Aplikasi Al-Quran Menggunakan Metode HCD (Human Centered Design)," *J. Repos.*, vol. 6, no. 1, pp. 59–68, 2024, doi: 10.22219/repositor.v6i1.31881.

[11] Faisal Maulana Akbar, Ayouvi Poerna Wardhanie, and Tan Amelia, "Implementasi Re-design UI/UX Website Fumigasi Untuk Meningkatkan Customer Experience," *J. Appl. Comput. Sci. Technol.*, vol. 4, no. 2, pp. 90–99, 2023, doi: 10.52158/jacost.v4i2.488.

[12] D. Anggraeni Dewi, Y. Yunarti, T. Mulyati, and R. Wahid, "Rancang Bangun Media Pembelajaran Pkn Berbasis Multimedia Interaktif Mobile Learning dalam Mengembangkan Literasi Kewarganegaraan Siswa," *Nat. J. Kaji. dan Penelit. Pendidik. dan Pembelajaran*, vol. 7, no. 2, pp. 1610–1617, 2023, doi: 10.35568/naturalistic.v7i2.3363.