BACHELOR IN COMPUTER SCIENCE (HONS)

DESIGN AND IMPLEMENT EDUCATIONAL "CYBERSHIELD" GAME APPLICATION

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BACHELOR IN COMPUTER SCIENCE (HONS)

MANAGEMENT & SCIENCE UNIVERSITY

2024

2024

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DESIGN AND IMPLEMENT EDUCATIONAL "CYBERSHIELD" GAME APPLICATION

By

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Project Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor in Computer Science (Hons) in the Faculty of Information Sciences and Engineering

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ABSTRACT

This thesis introduces the development of "CyberShield," an educational game designed to address the psychological, social, and health implications of mobile gaming, particularly among Malaysian adolescents. With the rising prevalence of online game addiction and the challenges posed by inadequate communication channels between teenagers and adults, CyberShield aims to enhance cybersecurity awareness and promote healthier gaming habits. The development process follows Agile methodology, ensuring a flexible, responsive approach to design and implementation. It involves stages such as requirements analysis, design, development, testing, deployment, and feedback. CyberShield incorporates gamified learning modules that simulate real-world cyber threats, adaptive challenges, and collaborative elements to engage users effectively. A mixed-methods research approach, combining quantitative and qualitative methods, was employed to evaluate the game's effectiveness and identify areas for improvement. Preliminary results from a pilot study, which engaged 32 respondents including students and educators, indicate a 68% positive reception towards CyberShield. This suggests that gamified approaches can effectively impart cybersecurity concepts and skills, contributing to a safer digital environment. The thesis highlights CyberShield's potential in fostering better cybersecurity practices and healthier gaming behaviors among adolescents. Looking ahead, further enhancements could include integrating additional learning modules and expanding collaborative features to deepen user engagement and educational impact.

Keywords: Cybersecurity Awareness, Gamification, Agile Computing, Online Game Addiction, Mobile Games

ACKNOWLEDGEMENT

I extend my heartfelt gratitude to those who have contributed significantly to the realization of this thesis, titled "Design and Implement Educational "Cybershield" Game Application." Foremost, I would like to express my deep appreciation to my dedicated thesis supervisor, Dr.Ahgalya Subbiah, whose unwavering guidance and support have been instrumental throughout this research endeavour. I also wish to thank the esteemed faculty members of Management and Science University (MSU) for their invaluable academic mentorship. My family and friends deserve special thanks for their unwavering support and motivation. I'm grateful to the research community, professionals, and organizations that generously shared resources and expertise. The academic community and my fellow students created an intellectually stimulating environment. Lastly, I acknowledge the collective efforts that contributed to the success of this thesis and the Design and Implement Educational "Cybershield" Game Application, without which this achievement would not have been possible. Thank you all for your unwavering support and encouragement on this remarkable journey.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The project titled "Design and development of Educational CyberShield Game Application" addresses the pervasive issue of online game addiction and its impact on the mental health of students, children, and individuals worldwide. In the context of Malaysia, where cases of online game addiction have been on the rise between 2021 and 2023, the detrimental effects on the well-being of the population have become increasingly evident.

Online game addiction poses a significant challenge due to the lack of effective communication between teenagers and adults in the community. Manual updating of program information exacerbates the problem, making it a time-consuming and expensive process, further hindering individuals seeking help for their addiction. To confront these challenges, the project proposes the development of an educational computer game named "CyberShield." This game not only aims to promote awareness of cybersecurity but also addresses the urgent need for understanding and managing the risks associated with excessive gaming. The incorporation of real-life cases from Malaysia between 2021 and 2023 within the game provides a localized context, making the educational experience more relevant and impactful.

The "CyberShield" educational game project recognizes the global issue of online game addiction and acknowledges its specific manifestations in Malaysia. By providing an interactive learning experience, the game seeks to empower individuals of all ages with the knowledge and skills necessary to responsibly manage their gaming habits. Moreover, it goes beyond mitigating addiction by fostering healthy online behaviors and promoting a balanced approach to gaming, thus reducing the adverse impact on mental health. In addition to addressing the societal concerns related to game addiction, the project incorporates elements of cybersecurity and the game development environment.

One important and current challenge in the development of the 'CyberShield' educational game revolves around effectively engaging an audience with potentially limited attention spans and varying levels of interest in the information about online game addiction and its impact on mental health. Additionally, ensuring that the game content is accessible and inclusive for all Players, regardless of their background or expertise, pose another significant challenge. To overcome these obstacles, it is crucial to gather a diverse range of feedback, reviews, and input from potential players and mental health experts. This inclusive approach is essential in ensuring that the game effectively caters to the distinct needs of its users. Lastly, the long-term maintenance and updates of the game are also considerations that require attention, as the understanding of online game addiction and mental health is an evolving field that necessitates continuous adaptation and improvement.

To continue the literature review, in recent years, there has been an increasing focus on the impact of online game addiction on mental health. One specific area of concern is the Blue Whale Challenge, which has transitioned from an urban legend to a real harm. Zhu, Harris, Zhang, and Ksenia (2022) conducted a research study with the objective of analyzing case studies of Chinese suicide attempters associated with the Blue Whale Challenge. To gather data, the researchers collected 131 news reports from online sources, including news websites, BBS, and social media platforms, using search terms like "Blue Whale Challenge" and "Wake Me Up at 4:20". After reviewing and analyzing the reports, seven cases were identified that met the study criteria. These cases provided valuable insights into the background of the player-victims, their participation stages in the Blue Whale Challenge, the process and effects of help interventions, as well as details of individuals who intervened or assisted the player-victims. This research contributes to the understanding of the real harm caused by the Blue Whale Challenge and emphasizes the need for comprehensive comprehension of online game addiction's impact on mental health.

Several studies have examined the impact of online game addiction on mental health. For example, A.I. Wang (2022) conducted a systematic review to investigate the health effects of playing Pokémon Go and how players' motivation affects their attitude towards the game. The review found that playing Pokémon Go has effects on physical, mental, and social health, and players' motivation influences their attitude towards the game. Another study by Maria Waris Nawaz et al. (2020) focused on the impact of PUBG game addiction on social isolation and narcissistic tendencies among gamers. The study used a survey conducted on PUBG gamers in Pakistan and found that playing online games like PUBG can boost social interactions and establish good interpersonal skills among peers. The study also found that most respondents viewed playing PUBG as a leisure activity rather than an addiction.

In conclusion, the "CyberShield" educational game project not only enhances cybersecurity awareness and readiness but also addresses the issue of online game addiction and its impact on mental health. By providing valuable information and promoting healthy online behaviors, the project contributes to creating a safer and more balanced digital landscape for individuals worldwide. To effectively engage players and ensure inclusivity, gathering feedback from potential players and mental health experts is crucial. Additionally, the long-term maintenance and updates of the game should consider the evolving understanding of online game addiction and mental health, ensuring the content remains relevant and helpful to players.

1.2 Problem Statement ✓

One of the significant issues related to online game addiction is the lack of awareness and understanding among individuals, particularly parents and guardians, about the potential risks and consequences associated with excessive gaming. Many people are unaware of the signs of addiction and fail to recognize when someone is struggling with online game addiction, hindering their ability to take appropriate measures to prevent or address it effectively. This lack of awareness leads to detrimental effects on mental health, relationships, and overall well-being as individuals continue to engage in excessive gaming habits. Moreover, previous studies have not adequately addressed the factors of online game addiction, particularly dimensions that have recently attracted research interest in other disciplines. For instance, Farah, Ragamustari, and Fajar (2021) explored the impact of the E-Sport Curriculum on online game addiction, while Nurullah, Karaali, and Sinan (2021) examined the COVID-19 pandemic's effect on students' loneliness and digital game addiction levels. Another problem is the insufficient support and resources available for individuals already addicted to online games. The limited availability of counseling services, treatment programs, and support groups specifically tailored to address online game addiction exacerbates the issue, making it challenging for individuals to seek help and recover. Furthermore, inadequate regulation and control of online gaming platforms contribute to the problem, with many lacking effective measures to prevent excessive gaming and mitigate addiction risks. The absence of age verification mechanisms, limited parental controls, and insufficient monitoring of gaming habits make it easier for individuals, especially minors, to become addicted. Researchers like Scott, Ryan, Nathan, and Samuel (2020) have also highlighted the media framing of video game addiction as a mental illness. Addressing these issues requires raising awareness about online game addiction, providing accessible support and resources for those affected, and advocating for improved regulation and control measures on online gaming platforms to protect vulnerable populations and promote healthier gaming habit.

1.3 Aims and Objective

The aims and objectives of this project revolve around the design and implementation of an educational game application called "CyberShield".

To achieve this aim, several objectives have been identified:

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I. To Understand Gamified Learning Modules

Enhance comprehension of cybersecurity principles by incorporating targeted learning modules within the "CyberShield" game. These modules will simulate real-world cyber threats and guide players to apply cybersecurity principles in an engaging and gamified environment.

II. To identify adaptive learning issues and performance

Recognize the value of an adaptive learning application within the game to tailor the difficulty and content of challenges based on individual player performance. This feature ensures that each player receives a personalized and effective learning experience.

III. To Cultivate Collaborative Learning and Community Engagement

Facilitate a dynamic learning environment within the "CyberShield" game by incorporating robust social features. The primary aim is to encourage collaboration among players, fostering a strong sense of community. Users should be able to seamlessly share their experiences, engage in discussions on cybersecurity topics, and actively participate in team-based challenges. These features are designed to deepen the understanding of cybersecurity principles through collaborative learning experiences.

1.4 Project Scope ✓

1.1.1 User Scope

- Users can register and log in to the "CyberShield" game.
- Users can engage in interactive scenarios to make decisions and protect their virtual identity.
- Users can participate in quizzes to test their cybersecurity knowledge.
- Users can follow a storyline that guides them through various cybersecurity challenges.
- Users can provide feedback on the game experience through post-game surveys and focus group discussions.

1.1.2 Admin Scope

- Admin can create and manage user accounts in the "CyberShield" game.
- Admin can monitor and analyze gameplay analytics to understand how players engage with the game.
- Admins can gather feedback from users through post-game surveys and focus group discussions.

1.1.3 System Scope

- The system provides registration and login functionality for users and admins.
- The system offers interactive scenarios, quizzes, and a storyline to educate users about cybersecurity.
- The system collects pre- and post-game assessment data to evaluate changes in participants' knowledge and behavior.
- The system analyzes gameplay analytics to understand user engagement.

1.5 Significant of Study

The significance of this study lies in addressing the pressing issue of cybersecurity awareness and readiness in the face of increasing cyber threats and security breaches. By developing an engaging and educational computer game called "CyberShield," this study aims to raise cybersecurity awareness, impart practical skills, and promote safe online behaviors among users of all ages.

Through a comprehensive research design, including literature review, game development, user testing, and evaluation, this study seeks to evaluate the impact of the "CyberShield" game on improving cybersecurity awareness and behavior among players. By recruiting participants from diverse age groups, educational backgrounds, and levels of cybersecurity knowledge, the study aims to gather valuable insights on the game's usability, engagement, and educational value.

The research methodology involves using a mixed-methods approach, including surveys and gameplay analytics, to assess the game's impact. By collecting data on participants' cybersecurity knowledge and online behavior before and after playing the game, the study aims to analyze changes in knowledge and behavior. Additionally, feedback gathered through post-game surveys and focus group discussions will provide valuable insights into the game experience and player engagement.

Ultimately, this study aims to offer an innovative and interactive solution to the lack of cybersecurity awareness and readiness, contributing to a safer digital environment for individuals and organizations.

1.6 Chapter Summary ✓

The comprehensive development and implementation of the educational game "CyberShield" is detailed across five chapters, each contributing crucial insights to its innovative approach in enhancing cybersecurity education. Chapter 1 outlines the research design, objectives, and collaborative game development process, setting the stage for subsequent chapters. Chapter 2 provides a literature review, laying the foundation with key terms and methodologies in educational gaming and cybersecurity awareness. Chapter 3 delves into the research methodology and Agile software development strategy, emphasizing iterative progression and user-centric design. Chapter 4 explores the mixed-methods approach through qualitative interviews with cybersecurity experts and quantitative student questionnaires, culminating in the pilot study's findings and the game's interface refinement. Finally, Chapter 5 encapsulates the project's contributions, challenges faced, and future directions, highlighting the significance of blending qualitative insights and quantitative data to advance cybersecurity education. Together, these chapters offer a comprehensive narrative of the "CyberShield" project, underscoring its potential impact on fostering cyber resilience through gamified learning tools.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The rapid advancement of technology has brought about unprecedented opportunities and challenges, as digital systems have become deeply integrated into every aspect of modern life. One of the major concerns that has arisen from this digital revolution is cybersecurity, which requires heightened awareness and proactive measures to protect individuals, organizations, and nations from cyber threats. In order to strengthen our defenses against these threats, educational initiatives have played a crucial role, with a specific focus on promoting cybersecurity awareness.

In this study, twenty research papers were conducted to explore the intersection of educational online gaming, cybersecurity awareness, and best practices in game design. Two of these papers focused on providing an explanation of key terms and terminologies related to educational online gaming, as well as reviewing relevant literature and technologies in the field. This helped to establish a foundational understanding of the concepts and principles underlying educational online gaming and its connection to cybersecurity awareness. Furthermore, the research examined the development and applicability of appropriate and current ideas, methods, and products relevant to educational online gaming. This involved a comprehensive review of various tools, technologies, methods, and products used in the creation of educational games aimed at promoting cybersecurity awareness. By exploring the practical research in this field, the study gained insights into the specific tools, technologies, methods, and products that are suitable for the development of the final product.

Additionally, a critical review of similar products or systems was conducted to assess their strengths, weaknesses, and effectiveness in promoting cybersecurity awareness. This evaluation provided valuable insights into existing educational online gaming systems, highlighting areas where improvements can be made and identifying potential gaps in the market. Moreover, a comparison was made

between similar systems and the proposed own system. This comparison allowed for a detailed analysis of similarities and differences in terms of features, effectiveness, and user experience. By examining similar systems, the study aimed to understand how the proposed own system can stand out and provide a unique and valuable educational gaming experience. The study also included a review of practical research, a critical assessment of similar products or systems, and a comparison between similar systems and the proposed own system.

2.2 Chapter Explanation of Key Terms and Terminologies

Cybersecurity awareness is of utmost importance as it involves comprehending and identifying potential online threats, prompting individuals and organizations to take proactive measures to safeguard sensitive information. Understanding various aspects of cybersecurity is crucial for preventing and mitigating cyber risks. Additionally, educational games play a pivotal role in this domain by offering interactive experiences that effectively impart knowledge and skills in an engaging and enjoyable manner. By integrating gamified elements, these educational games establish effective learning environments that render the acquisition of cybersecurity knowledge both engaging and impactful. In the following section, explanations and summaries of key terms and terminologies related to cybersecurity awareness and educational online gaming.

I. Gamification:
   - The integration of game elements, such as point systems, competition, and rewards, into non-game contexts, like education, to engage and motivate participants.

II. Serious Games:
   - Games designed for a primary purpose other than entertainment. Serious games aim to educate, train, solve real-world problems while incorporating game-like elements.

III. Immersive Learning:
   - Learning experiences that use technologies like Virtual Reality (VR) Or Augmented Reality (AR) to create a highly engaging and interactive environment.

IV. Edutainment:

- A blend of education and entertainment, where learning objectives are achieved through engaging and entertaining content.

V. Encryption:

- The process of converting information into a code to prevent unauthorized access. It ensures that only authorized parties can access and understand the data.

VI. Phising:

- A fraudulent attempt to obtain sensitive information, such as usernames, passwords, and credit card details, by disguising as a trustworthy entity in electronic communication.

In summary, gamification incorporates game elements into non-game contexts to engage and motivate participants. Serious games aim to educate or solve real-world problems while incorporating game-like elements. Immersive learning uses technologies like VR or AR to create highly engaging environments. Edutainment combines education and entertainment to make learning enjoyable. Encryption protects information by converting it into a code, and phishing refers to fraudulent attempts to obtain sensitive information. Understanding these key terms and terminologies is essential for comprehending the intersection of cybersecurity awareness and educational online gaming.

2.3 Reviewing of Relevant Literature and Technologies

In this section, review of relevant literature and explore various technologies that are pertinent to the development and implementation of educational games. By examining existing research and technological advancements, we aim to gain insights into the current landscape of educational game applications. This exploration will provide a foundation for understanding the potential benefits and challenges associated with integrating educational content into game-based learning experiences. In this comprehensive review, we will delve into three distinct strands of literature that significantly contribute to our understanding of the development and implementation of educational games which are mobile games, online game addiction, and mental health. The summary is presented in Table 2.3.

2.3.1 Mobile Game

The relevant literature and technologies related to mobile gaming encompass a wide range of studies and advancements. Research has delved into the psychological and social implications of heavy gaming, problematic gaming symptoms, and online socializing in adolescents, shedding light on the impact of video games on attachment, empathy, and socio- emotional functioning. Additionally, studies have explored the prevalence, psychosocial correlates, and prevention of adolescent internet addiction, providing insights into the sociodemographic profiles and addictive co-morbidities associated with excessive internet use. Furthermore, advancements in technology have led to the development of tools such as the Internet Addiction Test, which assesses addictive behaviors and socio-demographic risk factors in a large adult sample, contributing to the understanding of internet addiction and its implications. (Khatcherian, 2022).

The second mobile gaming highlight particularly among youth and adolescents. Studies have shown that excessive mobile gaming can lead to various health problems, including physical complaints such as headaches, neck pain, and wrist pain. Additionally, the impact of gaming on mental health, sleep patterns, and lifestyle disturbance has been documented. To address these concerns, interventions such as increasing awareness about gaming addiction,

limiting gaming time, and promoting outdoor activities have been suggested. Furthermore, research is ongoing to explore effective interventional strategies to combat gaming addiction among the youth. This literature underscores the need for a balanced and healthy approach to mobile gaming to mitigate its potential negative effects on individuals' well-being. (Bhaskar,2021).

Third literature review for mobile games encompass a wide range of topics, including user engagement, game design, monetization strategies, and technological advancements. Research in this area often focuses on understanding user preferences, behavior, and motivations to enhance player experience and retention. Technologies such as augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) are increasingly integrated into mobile game development to create immersive and interactive experiences. Additionally, the use of data analytics and machine learning algorithms enables personalized content delivery and targeted advertising within mobile games, contributing to the overall success and profitability of the mobile gaming industry. (Nwanosike,2022).

The fourth relevant literature for mobile games should focus on understanding the impact of game design and social factors on player addiction. Research should explore the relationship between game addiction and factors such as perceived social support, family climate, and adult attachment styles. Additionally, studies on the effects of game duration and frequency of play on addiction levels are crucial. Technologies that can track and analyze player behavior, engagement, and time spent in the game can provide valuable insights into identifying and preventing addiction in mobile gaming. Furthermore, the development of interventions and support systems based on the findings of these studies is essential for promoting responsible and healthy gaming habits. (Yilmaz and Ozkan, 2022).

Then, particularly in the context of Pokémon Go, encompass a wide range of studies and advancements. Additionally, the review highlights the use of augmented reality (AR) and location-based applications in the game, as well as the impact on public spaces and the environment. Furthermore, the review emphasizes the importance of understanding player motivation and attitudes

towards the game, including the influence of in-game purchases. In terms of technologies, the game's use of AR, GPS, and mobile devices has significantly contributed to its success and impact on players' daily lives, social interactions, and physical activity. (Laato,2021).

Next, literature review highlights the increasing popularity of mobile gaming, driven by the widespread use of smartphones and constantly improving mobile technology. It emphasizes the diverse range of game genres and the on-the-go gameplay experience as key factors contributing to the frequent downloads of mobile games. The study also addresses the design of online games to maintain player interest, balancing difficulty levels to prevent frustration and abandonment. Additionally, the review discusses the impact of mobile gaming on social development, financial concerns, and potential addiction among adolescents. It underscores the need for precautions to promote healthier technology usage and recommends equipping users with skills to manage technological advancements and digital adaptations effectively. (Faizah, 2023).

Other than that, surrounding mobile games, particularly in the context of the Blue Whale Challenge, emphasize the need for a comprehensive understanding of the impact of digital platforms on adolescent behavior and mental health. Studies have highlighted the association between internet overuse, video game exposure, and cyberbullying with increased suicide risk among adolescents. Additionally, the use of social media and online platforms has been identified as influential in shaping adolescent behavior and mental health outcomes. The literature also underscores the importance of integrating technology, curriculum, and open educational resources in addressing the impact of digital platforms on adolescent well-being. Furthermore, there is a call for revised suicide prevention methods led by digital natives in collaboration with government, media, and communities to address unique contemporary risks associated with mobile games and online activities. (Zhu,2023).

In addition, mobile games particularly focusing on titles like FIFA, PES, and Clash of Clans, highlights the psychological effects of these games on young men at risk of developing Internet Gaming Disorder (IGD). The research emphasizes the impact of gaming addiction on mental health, executive functions, and social relationships. It also underscores the need for identifying individuals at risk of addiction and implementing strategies to manage game time effectively to prevent adverse effects on mental health and daily functioning. This review provides valuable insights into the psychological implications of mobile gaming and the importance of addressing potential risks associated with excessive gameplay. (Amani, 2023).

Furthermore, mobile games encompass a wide range of topics, including game design, user experience, monetization strategies, and technological advancements. Research in this area often delves into player engagement, retention, and the impact of in-game mechanics on player behavior. Additionally, studies explore the integration of emerging technologies such as augmented reality (AR) and virtual reality (VR) in mobile gaming, as well as the influence of social media integration and live events on player interaction. Understanding player preferences, market trends, and the utilization of analytics and machine learning for personalized gaming experiences are also key areas of focus within the literature and technologies related to mobile games. (Towery and Hakim, 2020).

The impact of online games on children's lives, particularly in relation to violence, manipulation, and cybervictimization, has been a subject of research and concern. Studies have highlighted the risks associated with adolescents' active participation in online gaming, including the potential for increased aggression and hostility. Furthermore, the widespread availability of the internet and mobile devices has amplified these concerns, as adolescents are vulnerable to online threats, intimidation, and manipulation. As a result, there is a growing need for interventions and prevention programs to address the urgent problem of cybervictimization in online games. This research underscores the importance of understanding and mitigating the negative impacts of online gaming on adolescents' wellbeing and safety. (Ybarra, 2006).

Subsequently, has shown a significant increase in scientific interest and research in this area over the past decade. Studies have focused on various aspects of mobile gaming, including the impact on psychological, social, and physical health, as well as the development of diagnostic instruments and assessment tools. Additionally, the relationship between mobile gaming and social anxiety has been explored, highlighting the potential implications for individuals with social anxiety. Technological advancements in mobile gaming platforms and devices have also been a key focus, with an emphasis on understanding the effects of excessive mobile gaming and its potential comorbidities. Overall, the literature and technologies related to mobile gaming have provided valuable insights into its multifaceted nature and its impact on individuals' well-being. (Gioia,2022).

The literature review highlights the negative effects of excessive and inappropriate use of computers, the internet, and digital games on students' social relations, physical and mental health, as well as academic and personal development. Game addiction is described as an impulse control disorder characterized by symptoms such as the inability to control time spent on game-playing, loss of interest in other activities, continuing to play despite adverse effects, and feeling psychologically deprived when unable to play. The Covid-19 pandemic has exacerbated these issues, leading to increased loneliness and digital game addiction levels among students. The study suggests that physical activity and sports can be effective in reducing game addiction and loneliness, and it emphasizes the need to protect individuals from the negative impact of excessive technology use. (Wang, 2019).

In addition, mobile games encompass a wide range of topics, including the prevalence of internet gaming disorder (IGD) and its impact on mental health, especially during the COVID-19 pandemic. Studies have focused on the psychological distress associated with problematic online gaming, the distinction between high involvement and pathological involvement in video games, and the risk factors and protective factors associated with IGD. Additionally, research has explored the use of information and communication technology (ICT) and its potential benefits and risks, as well as the

development of dependence on technology. Overall, the literature emphasizes the need for a comprehensive understanding of the psychological and behavioral aspects of mobile gaming and the potential implications for mental well-being. (Suner,2021).

The rapid development of technology has significantly impacted the gaming industry, particularly with the rise of mobile games. The phenomenon of online game addiction, especially among adolescents, has been a subject of extensive research during the COVID- 19 pandemic. Studies have shown that online game addiction can have detrimental effects on students' physical health, social skills, and academic performance. Additionally, the shift to online learning and increased screen time due to the pandemic has further exacerbated the issue. As a result, there is a growing need for technologies and interventions that can address and mitigate the negative impacts of online game addiction, especially in the context of mobile gaming. (Nurullah,2021).

Mobile gaming highlights the increasing prevalence of Internet Gaming Disorder (IGD) and its impact on psychological distress among young adults. The study emphasizes the need to understand the cognitive factors underlying IGD, particularly in the Indian population, and identifies seven distinct cognitions related to IGD, such as preference for online social interaction, mood regulation, and self-escapism. The research also underscores the importance of preventative educational measures, involvement of family members, and society's support in promoting a healthy lifestyle for individuals affected by IGD. Additionally, the study recommends the adoption of cognitive behavioral therapy and the support of abstinence from gaming as interventions to improve problematic gaming cognitions and behaviors. These findings contribute to the growing body of literature on the psychological impact of mobile gaming and provide valuable insights for addressing IGD and promoting mental wellbeing in the context of mobile game usage. (Ismail,2020).

Another paper highlights the increasing prevalence of online game addiction, particularly among adolescents, and its potential impact on mental health. The study emphasizes the negative correlation between problematic

online gaming behavior and various subjective health outcomes, indicating a 1.57 times higher likelihood of mental health disorders in adolescents with online game addiction. Additionally, the review underscores the need for early prevention efforts to address internet gaming disorder and mitigate the symptoms of internet addiction and online games. Furthermore, it acknowledges the positive benefits of online games while also recognizing the potential for harmful effects, particularly in a small group of individuals. (Javed and Kakul, 2023).

Last but not least, mobile games encompass an exploration of the impact of smartphone addiction on adolescent mental health and social interactions. It involves an analysis of studies that demonstrate the prevalence of smartphone addiction among teenagers, the correlation between excessive smartphone uses and mental health issues such as anxiety and depression, and the influence of smartphone addiction on social interactions. Additionally, the review may also encompass an examination of technologies related to mobile gaming, including the development of gaming apps, user engagement strategies, and the psychological effects of gaming on adolescents. (Nurmala,2021).

2.3.2 Online Game Addiction

The literature on online game addiction encompasses studies examining its prevalence and impact, the potential role of the E-sport Curriculum Policy as an intervention, diagnostic guidelines such as the DSM, technological interventions within the gaming industry, and the recognition of cultural and regional variances in addiction patterns. This multidisciplinary approach reflects a comprehensive effort to understand and address the complexities of online game addiction, integrating psychological, educational, and technological perspectives to develop effective strategies for prevention and intervention. (Mumtaz,2021).

The second online game addiction highlights the significant impact of excessive gaming on adolescents, particularly in the context of social and emotional functioning. Studies have shown that heavy gaming and problematic

gaming symptoms can lead to social isolation, attachment issues, and empathy deficits in children and adolescents. Additionally, internet addiction, including gaming addiction, has been associated with feelings of loneliness and increased risk of suicidal ideation among adolescents. The World Health Organization has recognized internet addiction as a public health issue, emphasizing the need for effective prevention policies. However, further research is needed to fully understand the complex interaction between online game addiction, loneliness, and its implications for adolescent mental health. (Khatcherian,2022).

Third, relevant literature and technologies for online game addiction include studies on the prevalence of addiction to online video games, the impact of gaming disorder on psychiatric symptoms, and the use of diagnostic tools such as the Internet Gaming Disorder Test (IGDT)- 10 questionnaire. Additionally, research has focused on the relationship between emotional intelligence, perceived stress, and internet use behavior among undergraduate medical students. It is also important to explore effective intervention strategies for gaming addiction among youth, especially medical students, and to raise awareness regarding gaming addiction and its impact on mental health. (Bhaskar,2021).

Fourth, relevant literature on online game addiction highlights the detrimental impact of internet gaming disorder (IGD) on individuals' psychological, academic, and social wellbeing. Studies have shown that IGD can lead to compulsive and excessive gaming behavior, resulting in negative consequences such as impaired real-life relationships, academic performance, and mental health issues. Additionally, the literature emphasizes the association between IGD and social bullying, suggesting that individuals with gaming addiction may exhibit aggressive and bullying behaviors, particularly in online environments. Technologies such as diagnostic tools and interventions for IGD have been developed to address this issue, including psychometric scales for measuring IGD and therapeutic approaches aimed at mitigating the adverse effects of gaming addiction. (Nwanosike,2022).

Then, online game addiction emphasizes the impact of digital gaming behavior on the wellbeing of individuals, particularly young people. Studies have identified factors such as family climate, perceived social support, and adult attachment styles as influential in the development of game addiction. Additionally, the frequency and duration of gaming have been linked to negative consequences on biological, psychological, social, and academic aspects of well-being. Protective factors against game addiction are also highlighted, and there is a recommendation for the use of qualitative research methods to gain detailed insights from esports players regarding these factors. This literature underscores the need for a comprehensive understanding of the psychosocial aspects of online game addiction and the development of appropriate interventions and support systems. (Yilmaz and Ozkan, 2022).

Next, online game addiction highlights the need to examine the impact of various online games on individuals' behavior and mental health. It involves analyzing the addictive qualities of different gaming platforms, the psychological and social effects of prolonged gaming, and the technological features that contribute to addictive behaviors. Understanding the interplay between game design, user engagement, and addiction is crucial for developing effective interventions and support systems for individuals struggling with online game addiction. (Laato,2021).

Other than that, the implications of excessive technology usage and gaming on mental health and social behavior. Studies have shown that excessive or compulsive use of computer and video games can lead to hyperactive tendencies, self- control issues, and lack of mindful decision-making. Additionally, the addictive nature of online gaming has been associated with social isolation, narcissistic tendencies, and negative impacts on physical and psychological health. Technologies such as online multiplayer games have been found to activate dopaminergic neurotransmitters in the brain's reward circuit, influencing behavior and mood. Furthermore, the prevalence of online game addiction among youth has raised concerns about its potential effects on mental well-being and social interactions. (Kim,2008).

In addition, online game addiction highlights the impact of the Covid-19 pandemic on the rise of gaming addiction, particularly among adolescents. Studies have focused on the characteristics and features of online gaming, such as game design, relationship or connection during gameplay, and mode of gaming, which have significant impacts on compulsive behavior. Additionally, the technological capability of multiplayer online games (MMOs) to host large numbers of players in a persistent world has been identified as a contributing factor to the addictive nature of online gaming. Furthermore, the use of technology, particularly among adolescents, has been emphasized as a factor that requires promotion of healthy usage to prevent online addiction. The literature also addresses the need for early detection of compulsive behaviors and the implementation of precautions to help adolescents use technology in a healthier manner. (Nur Faizah Abdul Kahar,2023).

Furthermore, the need for increased awareness and prevention efforts. Studies have focused on analyzing the impact of online games on mental health, particularly in adolescents, and have identified themes such as low mood, interpersonal problems, and poor school performance as antecedents to game- related suicide attempts. Thematic analysis has been used to understand the behaviors and consequences of individuals involved in online game challenges. Additionally, there is a call for revised suicide prevention methods led by digital natives in collaboration with government, media, and communities to address contemporary risks associated with online game addiction. This research emphasizes the importance of increased online efforts and interventions at various stages of victim involvement, particularly in educational settings, to address personal difficulties and prevent adverse outcomes. (Zhu,2023).

Subsequently, the significant impact of gaming on mental health, particularly in young adults. Studies have identified a strong association between internet gaming disorder (IGD) and mental health problems, including depression, social anxiety, loneliness, and behavioral issues. Additionally, research has shown that excessive gaming can lead to difficulties in stopping play, preoccupation with gaming, and negative effects on daily activities.

Furthermore, the development and validation of assessment tools, such as the Metacognitions about Online Gaming Scale, have provided valuable insights into the cognitive and psychological aspects of online game addiction. Overall, the literature emphasizes the need for effective strategies to manage and prevent IGD, particularly among young individuals at risk of developing this disorder. (Amani, 2023).

Another paper for online game addiction has been the subject of extensive research and debate. The World Health Organization's identification of "gaming disorder" as a mental illness in 2019 sparked significant discussion and controversy within the gaming industry, among gamers, and researchers. This decision prompted a cross-disciplinary review and news media framing analysis to understand how journalists portrayed gaming disorder. The study involved the examination of news coverage leading up to and following the classification, shedding light on the framing of the issue and its implications. Additionally, advancements in technology, particularly in the field of psychology research and behavior management, have contributed to the understanding and treatment of online gaming addiction. (Towery and Hakim, 2020).

The impact of online games on children's lives, particularly in relation to addiction, has been a subject of interest for psychologists and researchers. Studies have highlighted the potential negative effects of online gaming, such as violence imposing, manipulation, and cybervictimization. This has led to the identification of principles for intervention and prevention programs, as well as the need for raising awareness among adults and implementing anti-bullying strategies in educational environments. Additionally, the prevalence of online gaming addiction among adolescents has prompted the exploration of methodologies to address this issue, with a focus on team building, individualized educational activities, and the involvement of all participants in the educational environment. (Ybarra,2006).

The review of relevant literature and technologies on online game addiction has shown a significant correlation between problematic online

gaming and social anxiety. Studies have identified social anxiety as a pivotal risk factor for both problematic gaming and online gaming addiction, with higher levels of social phobia associated with higher scores in identification with avatars and Internet gaming disorder symptoms. Additionally, the review highlighted the psychosocial factors and personality characteristics associated with problematic online gaming, emphasizing the need for a better understanding of the relationship between social anxiety and excessive online gaming. This comprehensive review utilized various research databases and followed PRISMA guidelines, providing valuable insights into the complex interplay between online gaming addiction and social anxiety. (Gioia,2022).

In addition, online game addiction has shown a strong focus on the relationship between gaming addiction and mental health outcomes, particularly social anxiety, depression, and loneliness among adolescents. Studies have highlighted the co- occurrence of internet addiction and depression, indicating a possible bidirectional relationship. Additionally, research has emphasized the impact of mobile game addiction on social anxiety, depression, and loneliness, with a specific focus on gender differences in these associations. The literature also discusses the limitations and implications for mental health practice in addressing mobile game addiction. (Wang,2019).

The literature indicates that excessive and inappropriate use of computers and the internet, particularly in the form of online game addiction, can have negative effects on social relations, physical and mental health, as well as academic and personal development. Game addiction has been described as an impulse control disorder characterized by symptoms such as the inability to control time spent on game-playing, loss of interest in other activities, continuing to play despite adverse effects, and feeling psychologically deprived when unable to play. Studies have also shown that prolonged exposure to video games is associated with a higher risk of sadness, suicidal ideation, and planning among youths. Additionally, the increase in technological developments and the convenience of accessing technological devices have been identified as contributing factors to the rise of game

addiction, leading to decreased interaction with society and increased feelings of loneliness. (Suner,2021).

Other than that, game addiction highlights the prevalence of internet gaming disorder (IGD) and its association with psychological distress, particularly during the COVID- 19 pandemic. Studies have identified risk factors associated with online game addiction, including socio demographic background, individual factors, cognitive factors, and psychopathological conditions. Additionally, the cognitive psychology of internet gaming disorder has been explored, emphasizing the distinction between high involvement and pathological involvement in video games. Technologies such as online gaming platforms and social media have been implicated in contributing to the severity of internet gaming disorder, with relationships found between the severity of IGD, problematic social media use, sleep quality, and psychological distress. Furthermore, the use of information and communication technology (ICT) has been recognized as both crucial and potentially risky, necessitating caution and preventive measures for individuals vulnerable to developing overdependence on online gaming and other digital technologies. (Nurullah,2021).

Moreover, online game addiction highlights the detrimental impact of excessive gaming, particularly among children and adolescents. Studies have shown that online game addiction can lead to negative effects on mental health, social skills, and academic performance. The COVID-19 pandemic has exacerbated this issue, with increased game usage reported during the crisis. Technologies such as online video games have been identified as contributing factors to addiction, with their immersive and interactive nature potentially leading to time distortion, inattention, and aggressive behavior among young individuals. Understanding the psychological and social implications of online game addiction is crucial for developing effective interventions and policies to mitigate its impact on the quality of student education and overall well-being. (Ismail,2020).

Several studies have been conducted to assess the prevalence and impact of internet gaming addiction, with a focus on young adults. Research has

examined the cognitive and psychological aspects of problematic gaming beliefs, as well as the association between internet gaming disorder (IGD) and psychological distress. Additionally, technologies such as online platforms and gaming systems have been identified as potential contributors to the increasing prevalence of IGD, highlighting the need for further research and preventative educational measures to address this growing health concern. (Javed and Kakul, 2023).

Another study on online game addiction reveals a growing concern about the detrimental impact of excessive gaming on adolescent mental health. A systematic review and meta-analysis study identified 20 relevant articles, indicating a strong negative correlation between problematic online gaming behavior and various subjective health outcomes. The research emphasizes the need for early prevention efforts to mitigate the symptoms of internet addiction and online games, highlighting the importance of multi- stakeholder approaches involving researchers, doctors, regulators, government agencies, community organizations, and industry to reduce harm and promote awareness about the dangers of online game addiction among adolescents. This comprehensive approach is essential to address the psychological distress, depression, anxiety, and other adverse effects associated with internet gaming disorder (IGD) and its implications for adolescent well-being. (Nurmala,2021).

Last but not least, online game addiction reveals a growing concern about the impact of excessive gaming on mental health and social behavior, particularly among adolescents. Studies have shown a correlation between online game addiction and issues such as anxiety, depression, and social isolation. Furthermore, advancements in gaming technologies, including immersive virtual reality and multiplayer online platforms, have contributed to the addictive nature of online gaming. The prevalence of online game addiction has prompted researchers and mental health professionals to explore intervention strategies and technological solutions aimed at mitigating the negative effects of excessive gaming on individuals' well-being and social interactions. (Amalya,2019).

2.3.3 Mental Health

The relevant literature on online mental health emphasizes the increasing public health concerns related to excessive internet use and online gaming addiction, particularly among adolescents. Studies have identified the negative psychological and physical impacts of excessive online gaming, such as social isolation, suicide, lack of sleep, and hypertension. The emergence of the E-sport Curriculum Policy in Indonesia is seen as a potential intervention to address the growing issue of game addiction among adolescents. This policy aims to not only measure online game addiction but also assess adolescents' achievement in gaming, potentially leading to professional careers in e-sports or as influencers. (Mumtaz,2021).

The second study focused on the implications of loneliness, and suicidal ideation in adolescents. The search was performed using online databases including Scopus, PubMed, and PsycINFO, with keywords related to adolescent loneliness, suicidal ideation, and problematic use of the internet. However, the review did not yield any results, indicating a limited availability of literature on this specific topic. The study emphasized the need for further research to understand the complex interaction between internet addiction, loneliness, and suicidal ideation in adolescents. Additionally, the study highlighted the importance of addressing internet addiction and loneliness in adolescent suicide prevention, especially in the context of the COVID-19 pandemic and its impact on adolescent mental health. (Khatcherian,2022).

The third paper focused on online mental health has increasingly focused on addressing issues such as technology addiction, gaming disorder, and the psychological impact of excessive digital gaming. Studies have highlighted the prevalence of problematic gaming among medical students, emphasizing the need for timely intervention and awareness. Additionally, the use of diagnostic tools such as the Internet Gaming Disorder Test (IGDT-10) based on the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) scale has been employed to estimate the prevalence of gaming addiction. Furthermore,

the World Health Organization's classification of Internet Gaming Disorder (IGD) as a diagnosable mental disorder has prompted research into effective intervention strategies and the promotion of healthy technology use. These efforts underscore the importance of leveraging technology to raise awareness, provide support, and develop interventions for mental health issues associated with technology use. (Bhaskar,2021).

The fourth paper for online mental health encompasses a wide range of studies and tools aimed at addressing mental health concerns through digital platforms. These include research on internet addiction, social media use, and online gaming, as well as interventions such as teletherapy, mobile mental health apps, and virtual support groups. Additionally, advancements in artificial intelligence and natural language processing have enabled the development of chatbots and virtual assistants designed to provide mental health support and information. These technologies and research findings contribute to the growing field of online mental health, offering innovative ways to deliver mental health services and support to individuals through digital means. (Nwanosike,2022).

The fifth paper encompasses a wide range of resources and tools aimed at providing support, intervention, and therapy for individuals experiencing mental health challenges. These include online counseling platforms, mobile applications for mental well-being, teletherapy services, and digital interventions for specific mental health conditions. Additionally, research articles, academic journals, and evidence- based studies contribute to the body of knowledge surrounding online mental health interventions. The integration of artificial intelligence and machine learning in mental health assessment and support tools is also an emerging area of interest. Overall, the literature and technologies in this field emphasize accessibility, affordability, and effectiveness in delivering mental health care and support to diverse populations. (Yilmaz and Ozkan, 2022).

Then, the positive impact of digital platforms on mental well-being. It emphasizes the use of technology to provide accessible mental health support,

including virtual therapy sessions, mental health apps, and online support communities. The literature also discusses the effectiveness of digital interventions in addressing various mental health concerns, such as anxiety, depression, and stress. Additionally, it explores the integration of artificial intelligence and machine learning in mental health technologies to personalize interventions and improve outcomes for individuals seeking online mental health support. (Laato,2021).

Next, online mental health encompasses a wide range of resources and tools aimed at providing support and interventions for mental health concerns through digital platforms. This includes systematic literature reviews of neuroimaging studies to understand the implications of excessive technology usage and gaming on mental well- being, as well as studies on problematic internet use and its impact on self-esteem and self- control. Additionally, research on online gaming addiction and its correlation with psychological traits such as narcissism and social isolation contributes to the understanding of mental health issues in the digital age. Furthermore, advancements in telemedicine and digital mental health interventions, such as online counseling platforms and mental health apps, are also integral components of the literature and technologies available for addressing mental health concerns in the online space. (Kim,2008).

Other than that, the rise of gaming addiction, particularly amid the COVID-19 pandemic. Studies have identified online gaming platforms and peer influence as contributing factors to gaming addiction, leading to concerns about excessive screen time, financial implications, and virtual interactions. The presence of ICT and technological advancements has been recognized as beneficial during the lockdown period, but it also poses potential negative consequences if not used within limits. As a result, there is a growing need for digital adaptations and interventions to address and mitigate the proclivity for online gaming disorder, particularly in the context of mental health and well-being. (Nur Faizah Abdul Kahar,2023).

In addition, online mental health encompasses a wide range of topics, including the impact of internet use on mental health, cyberbullying, suicide risk, and the influence of social media on suicidal behaviors. Studies have also delved into the association between video game and internet overuse among teens and its link to sadness and suicide. Additionally, research has explored the role of online platforms in fostering friendships, romance, and sexual interactions. Furthermore, there is a growing body of literature on the use of social media and technology for suicide prevention, as well as the potential risks associated with online challenges such as the Blue Whale Challenge. These studies highlight the need for innovative approaches to address mental health issues in the digital age and emphasize the importance of leveraging technology for effective mental health interventions and support. (Zhu,2023).

Furthermore, online mental health has highlighted the significant impact of internet and gaming addiction on mental health, particularly among young adults. Studies have identified associations between excessive gaming, internet addiction, and adverse psychological outcomes such as depression, social anxiety, loneliness, and impaired executive functions. Furthermore, research has emphasized the need for targeted interventions and preventive measures to address the psychological effects of specific online activities, such as gaming, on mental health. This underscores the importance of leveraging technology to develop innovative solutions for identifying individuals at risk of addiction and providing accessible online mental health support and interventions to mitigate the negative impact of excessive internet and gaming use on psychological well-being. (Amani, 2023). ✓

Subsequently, mental health has emphasized a broad spectrum of topics, including the stigmatization of mental illness, and the psychology of human behavior in the context of technology. Research articles such as "Internet gaming addiction: current perspectives" by Daria J Kuss and "Gaming Disorder: News Media Framing of Video Game Addiction as a Mental Illness" by Parrott, Ryan, Nathan, and Samuel have contributed to the understanding of mental health issues related to technology. Additionally, the development of online platforms and applications for mental health support and intervention

has been a key technological focus, aiming to provide accessible and effective resources for individuals facing mental health challenges. (Towery and Hakim, 2020).

Another paper emphasizes the impact of cybervictimization on adolescents, highlighting the need for preventive programs and anti- bullying strategies. Studies have shown that adolescents are more susceptible to distress from cyberthreats than traditional bullying, with psychological factors such as self-esteem and social anxiety being associated with cyber victimization. The use of online games and the Internet's ability to instantly ease stress are also identified as contributing factors. To address this issue, the literature recommends the development of software services to control and prevent the distribution of malicious content, as well as the widespread introduction of training programs for law enforcement officials, school teachers, and parents of teenage children. These technologies and strategies aim to create a safer online environment and support the mental well-being of adolescents. (Ybarra,2006).

Research on mental health has seen a significant increase in interest and attention, particularly in the context of technology and digital platforms. Studies have explored the relationship between problematic online activities, such as gaming, and mental health issues, including social anxiety. The use of digital platforms for mental health interventions and assessments has also been a focus of research, with a growing emphasis on the development of innovative technologies and assessment tools. This trend reflects a recognition of the potential of technology to both exacerbate and alleviate mental health challenges, highlighting the need for continued exploration and advancement in this area. (Gioia,2022).

Moreover, mental health encompasses a wide range of studies and tools aimed at understanding and addressing mental health issues. Research in this area includes studies on the association between behavioral addictions, such as mobile game addiction, and mental health outcomes, as well as the impact of technology on psychological well-being. Additionally, technologies such as

mobile applications, telemedicine, and digital platforms have been developed to provide mental health support, therapy, and interventions. These tools often leverage artificial intelligence, machine learning, and data analytics to personalize and improve mental health care delivery. Overall, the literature and technologies in mental health reflect a growing emphasis on understanding the complex interplay between technology, behavior, and mental well-being, and the development of innovative solutions to support mental health. (Wang,2019).

Recent literature has highlighted the significant impact of the COVID-19 pandemic on mental health, particularly among children and adolescents. Studies have shown that prolonged school closures and home confinement have led to increased loneliness, digital game addiction, and reduced physical activity, which in turn have adverse effects on mental, physical, and psychosocial well-being. Additionally, excessive and inappropriate use of technological devices, such as computers, tablets, and phones, has been identified as a barrier to achieving a healthy lifestyle, further exacerbating mental health challenges. As a result, there is a growing emphasis on leveraging technologies and interventions to address mental health issues, including the use of digital platforms for therapy, telemedicine, and remote support from mental health professionals, as well as promoting physical activity and recreational activities to mitigate the negative impact of technology on mental well-being. (Suner,2021).

Mental health emphasizes the high prevalence of internet addiction and internet gaming disorder, particularly among medical students, with rates significantly elevated during the COVID-19 pandemic. This highlights the need for adaptive strategies to optimize care for the psychological wellbeing of individuals, especially in the context of increased internet usage. Technologies such as online platforms for mental health support, telemedicine, and digital mental health interventions have become increasingly important for providing timely and accessible mental health care, particularly during the pandemic. Understanding the psychological impacts of technology use and developing preventive measures, such as self-regulating screen time and promoting

healthy lifestyle habits, are crucial components of addressing mental health challenges associated with internet addiction and internet gaming disorder. (Nurullah,2021).

Research on mental health and technology has shown that the COVID-19 pandemic has significantly impacted the mental well-being of students, particularly in relation to online game addiction. Studies have highlighted the negative effects of excessive online gaming on students' mental health, including increased isolation, disrupted social interactions, and potential risks for the development of gaming disorders. Additionally, the shift to online learning during the pandemic has further exacerbated these issues, affecting students' productivity, creativity, and overall mental health. As a result, there is a growing need for innovative technologies and interventions to address mental health challenges, particularly in the context of online gaming addiction and the impact of remote learning on students' wellbeing. (Ismail,2020).

Another study highlights the increasing focus on Internet Gaming Disorder (IGD) and its impact on psychological well- being, particularly among young adults. The study emphasizes the prevalence of problematic gaming beliefs and psychological distress associated with IGD, shedding light on the need for interventions and support systems to address this issue. Additionally, the use of technology, particularly the Internet, has become a significant platform for various activities, including education, socializing, and entertainment, indicating the potential for leveraging technology for mental health interventions and support. (Javed and Kakul, 2023).

In addition, mental health, particularly in the context of online game addiction among adolescents, highlights the significant impact of excessive online gaming behavior on mental health. The systematic review and meta-analysis identified a strong negative correlation between online game addiction and various subjective health outcomes, with adolescents exhibiting 1.57 times higher mental health disorders when addicted to online games. The findings emphasize the importance of early prevention efforts to mitigate the symptoms of internet addiction and online gaming, underscoring the need for effective

policies, stakeholder involvement, and user protection measures to address the potential harm associated with online gaming activities. Additionally, the review underscores the role of family relationships and socio-cultural factors in influencing adolescent mental health, providing valuable insights for clinical practice and public health strategies aimed at promoting healthy offline and online behaviors among adolescent populations. (Nurmala,2021).

Last but not least mental health emphasizes the growing concern of smartphone addiction and its impact on adolescent mental health. Studies have shown a correlation between smartphone addiction and symptoms of depression, anxiety, and attention-deficit/hyperactivity. This highlights the need for interventions and technologies that can address smartphone addiction and promote positive mental health outcomes among adolescents. Additionally, the review underscores the importance of further research and the development of innovative technologies to mitigate the negative effects of smartphone addiction on mental health. (Amalya, 2019). The summary is presented in Table 2.3 below.

Table 2.3 Key Findings and Technologies

Category	Key Findings and Technologies
Mobile Game	Health issues associated with excessive mobile gaming.
	Interventions: awareness, limited gaming time, outdoor activities.
	Technologies: AR, VR, AI, data analytics for personalized content.
Online Game Addiction	Prevalence, impact on adolescents' social and emotional functioning.
	Diagnostic tools: DSM, IGDT-10 questionnaire.
	Technologies: Interventions, psychometric scales, therapeutic approaches.

Table 2.3 Key Findings and Technologies ✓

Mental Health	Negative impacts of excessive online gaming on mental health.
	E-sport Curriculum Policy as an intervention.
	Technologies: Teletherapy, mental health apps, AI and machine learning.

The comprehensive literature review explores three significant aspects of the development and implementation of educational games: Mobile Games, Online Game Addiction, and Mental Health. The findings highlight the health issues associated with excessive mobile gaming, the prevalence of online game addiction among adolescents, and the negative impacts of excessive online gaming on mental health. Interventions such as awareness programs, limited gaming time, and outdoor activities are suggested to address concerns. Moreover, technologies like AR, VR, AI, and data analytics play crucial roles in mobile game development and addiction prevention. The review emphasizes the need for a balanced approach to mobile gaming and comprehensive strategies to combat gaming addiction. Additionally, the integration of technologies, diagnostic tools, and interventions is crucial for addressing mental health issues associated with technology use. Overall, the literature underscores the importance of responsible and healthy gaming habits, awareness programs, and technological advancements in creating positive educational game experiences. ✓

2.4 Review of Current Ideas, Methods and Products ✓

The paper discusses the continuous evolution and application of contemporary ideas, methods, and products in the field of online game applications. The global gaming industry, valued at 48.2 billion US dollars, has seen significant growth, particularly in countries like Indonesia and Korea, where high internet usage among adolescents raises concerns about internet addiction. To address this, an esports curriculum is being implemented in schools, showing a significant impact on reducing game addiction behavior among adolescents in Indonesia.

The research incorporates mixed methods, including quantitative and qualitative approaches, to explore the influence of esports curriculum on game addiction. It emphasizes the need for local policy measures to address the consequences of game addiction. The broader context of online game application development is multifaceted, covering game design, user experience, technology, business models, and ethical considerations. Advanced technologies like virtual reality, augmented reality, artificial intelligence, and blockchain have been integrated to create immersive gaming experiences. Additionally, social and community features within online games are crucial for enhancing user engagement and retention.

In recent years, there has been a focus on the application of online games beyond entertainment, including educational, healthcare, and corporate training purposes. The integration of virtual reality and artificial intelligence has led to more interactive and realistic gaming environments, while the emergence of cloud gaming platforms has increased accessibility. The paper recognizes the dynamic nature of the gaming industry, with continuous advancements in mobile gaming, gamification of educational programs, and the exploration of new avenues such as blockchain technology and non-fungible tokens (NFTs). The integration of social media, community building, and in-game events contributes to the overall growth and diversification of the industry.

Moreover, the paper highlights the importance of addressing contemporary risks, such as the Blue Whale Challenge, by integrating innovative suicide prevention methods into online game applications. Collaboration with government, media, and communities is crucial to identifying and addressing potential warning signs among at-risk individuals. Several studies emphasize the need for proactive strategies to manage gaming addiction, considering the potential mental health impacts. The ongoing research and development in this field aim to strike a balance between the positive and negative aspects of online gaming, ensuring a safe and positive gaming environment for users. Table 2.4 presents the summary of papers conducted related to this project.

Table 2.4 Literature Review

Topic	Subtopic	Literature/Technology Focus	References
Mobile Game	General Health Impact	Excessive gaming is linked to physical complaints, mental health issues, sleep patterns disturbance. Interventions: awareness, time limits, outdoor activities. Ongoing research on addiction interventions.	Bhaskar, 2021
	Game Design and Technology	Focus on user engagement, game design, monetization. Integration of AR, VR, AIfor immersive experiences. Data analytics, machine learning for personalized content and targeted advertising.	Nwanosike, 2022
	Pokémon Go	Augmented reality, location-based aspects. Impact on public spaces, environment. Emphasis on player motivation, in game purchases.	Laato, 2021

Table 2.4 Literature Review (Cont 1…) ✓

	Blue Whale Challenge	Understanding digital platforms' impact on adolescent behavior, mental health. Association with internet overuse, video game exposure, and cyberbullying. Call for revised suicide prevention methods. Integration of tech, curriculum, and resources.	Zhu, 2023
Online Game Addiction	Impact on Adolescents	Heavy gaming is linked to social isolation, attachment issues, and empathy deficits. Internet addiction associated with loneliness and increased suicide risk. WHO recognizes internet addiction as a public health issue.	Khatcherian, 2022
	Prevalence and Diagnostic Tools	Studies on addiction prevalence, impact on psychiatric symptoms. Use of diagnostic tools like IGDT-10 questionnaire. Relationship between emotional intelligence, perceived stress, and internet use.	Bhaskar, 2021
	Social Bullying and Psychological Well-being	IGD is associated with negative consequences like impaired relationships, academic issues. Association with social bullying and aggressive behaviors. Need for diagnostic tools and therapeutic approaches	Nwanosike, 2022

Table 2.4 Literature Review (Cont 2…) ✓

	Psychosocial Factors Interventions	Factors like family climate, social support, attachment styles influence game addiction. Importance of qualitative research for insights. Need for comprehensive understanding and development of interventions.	Yilmaz and Ozkan,2022
Mental Health	Excessive Internet Use and Gaming	Concerns about social isolation, suicide, lack of sleep, and hypertension. E-sport Curriculum Policy As potential intervention.	Mumtaz, 2021
	Loneliness and Suicidal Ideation	Limited literature on the topic. Emphasis on further research on the complex interaction between internet addiction, loneliness, and suicidal ideation in adolescents. Importance in suicide prevention.	Khatcherian, 2022
	Technology-Based Mental Health Support	Range of studies and tools for mental health support through digital platforms. Teletherapy, mental health apps, virtual support groups. AI and machine learning for personalized interventions.	Nwanosike, 2022

In conclusion, the continuous innovation in technology, game design, and user engagement strategies has led to a diverse range of gaming experiences and increased the overall quality and applicability of online game applications. A multi-stakeholder approach involving researchers, doctors, regulators, government agencies, community organizations, and the industry is essential to prevent problematic technology use and reduce harm, especially among adolescent populations.

2.5 Review of Research on Tools, Technologies, Methods

The extensive examination of applied research in various fields showcases a thorough investigation into the tools, technologies, methodologies, and products that are pertinent to the creation of targeted solutions. Presented below is an elaborate overview of each area of research concentration:

I. Tools and Technologies for Online Educational Game Application:

- **NLP Tools:** Implement natural language processing tools to analyze and understand the language used in educational games, allowing for more personalized interactions and feedback.
- **ML Algorithms**: Use machine learning algorithms to adapt game difficulty based on individual student performance, providing a customized learning experience.
- **Language Models:** Incorporate advanced language models, similar to BERT and EMLo, to enhance natural language understanding and generation in educational game scenarios.
- **API Utilization:** Integrate relevant APIs for educational content, language translation, and speech recognition to enhance the interactive features of educational games.

II. Methods for Educational Game Application:

- **Adaptive Learning Algorithms:** Implement adaptive learning methodologies that adjust the difficulty and content of educational games based on the user's proficiency, ensuring an optimized learning curve.

- **Gamification Techniques:** Apply gamification principles to make learning more engaging, using elements such as rewards, achievements, and progress tracking.
- **User Feedback Systems:** Develop systems that provide constructive feedback to users, helping them understand their strengths and weaknesses in specific educational topics.
- **Interactive Assessments:** Design assessments within the game that evaluate the user's knowledge and skills in a way that feels integrated with the overall gaming experience.

III. Products for Online Educational Game Application:

- **Evaluation Frameworks:** Develop frameworks for evaluating the effectiveness of educational games in terms of learning outcomes, engagement, and user satisfaction.
- **User Experience (UX) Design:** Focus on creating intuitive and user-friendly interfaces to enhance the overall user experience for learners of different age groups.
- **Content Relevance:** Ensure that the educational game content aligns with curriculum standards and provides meaningful learning experiences.
- **Teacher/Administrator Dashboards:** Include tools for educators to monitor student progress, identify areas of improvement, and customize the learning experience for individual students.

In conclusion, these pragmatic research evaluations offer significant advancements in their respective disciplines, offering detailed perspectives on essential tools, technologies, methodologies, and products necessary for creating efficient resolutions across various domains.

2.6 Critical Review of Similar Products or System

The critical review explores three distinct applications which are Sudoku, Word Collect, and Duolingo. Each application caters to diverse interests and cognitive abilities. Sudoku, a classic number-placement puzzle, offers a mentally stimulating experience, but its potential for repetition is noted. Word Collect, a word puzzle game, provides an engaging challenge but may face issues related to a finite word set. Duolingo, a language-learning platform, excels in making education entertaining, yet it confronts challenges related to exercise monotony. This review aims to highlight the unique strengths and weaknesses of each application, assisting users in making informed choices based on their preferences. Table 2.6 present the Critical Review of Similar Products or Systems.

Table 2.6 Critical Review of Similar Products or Systems.

Application			
Developer	Nikoli Co Ltd	Super Lucky Games LLC	Luis von Ahn and Severin Hacker
Published	1979	2016	2012
Description	Sudoku is a logic-based number placement puzzle. The objective is to fill a 9×9 grid with digits so that each column, each row, and each of the nine 3×3 sub grids that compose the grid contain all of the digits from1 to 9. Sudoku game applications provide digital versions of this puzzle, allowing users to play and solve Sudoku puzzles on electronic devices such as smartphones, computers.	Word Collect is a popular word puzzle game application where players swipe letters to form words. These words are then used to fill out crossword-style grids. The game offers levels of increasing difficulty and often includes daily challenges and rewards, providing an engaging and educational experience for players of all ages.	Duolingo is a language learning platform and app that offers a wide range of language courses. It provides bite-sized lessons in the form of a game, using gamification to make language learning engaging and fun. The app offers various languages and uses interactive exercises to teach vocabulary, grammar, and speaking, listening, and writing skills.

Table 2.6 Critical Review of Similar Products or Systems (Cont 1…)

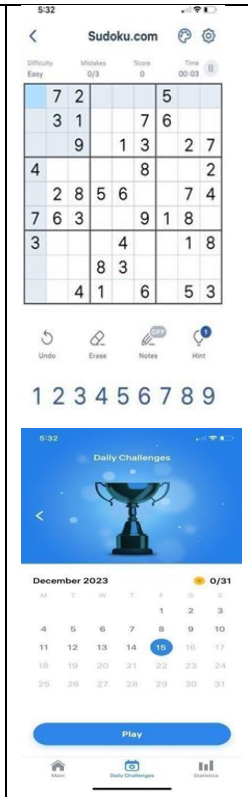
Game Layout			
Strength	• Sudoku challenges users' logical thinking and cognitive skills, promoting mental sharpness and problem-solving abilities. • Sudoku is suitable for a wide range of age groups, from children to seniors, making it an inclusive and universally appealing game.	• Design levels that progressively increase in difficulty to keep players challenged. • Incorporate visually pleasing themes and backgrounds. • Allow players to connect with friends through social media platforms.	• Duolingo uses a gamified learning approach, turning language learning into an engaging and enjoyable experience • Duolingo provides structured lessons that cover various language skills, including listening, speaking, reading, and writing.

Table 2.6 Critical Review of Similar Products or Systems (Cont 2…)

	• With algorithms generating puzzles dynamically, users have access to an almost infinite number of puzzles, preventing repetition and keeping the game fresh and engaging.		• The platform adapts to the user's progress, providing personalized learning experiences and adjusting difficulty levels based on performance.
Weakness	• Once players solve a Sudoku puzzle, there's little incentive to replay the same puzzle since the solution remains constant. • Many Sudoku apps stick to traditional puzzle formats without incorporating innovative features, leading to a potential lack of excitement for users seeking new challenges. • Many Sudoku apps lack robust social features, such as multiplayer modes or global leaderboards, which can reduce the sense of community or competition among players.	• have a finite set of words, leading to repetition and predictability, reducing the challenge for advanced players. • Excessive or intrusive advertisements can negatively impact the user experience, causing frustration and potentially leading users to abandon the game. • Poorly balanced difficulty levels may discourage casual players or frustrate advanced players, affecting the overall appeal of the game.	• Duolingo may not provide in depth knowledge of grammar rules or cultural nuances, focusing more on practical language use. • The gamified approach may prioritize scoring points and completing levels over the depth of language understanding, potentially leading to surface-level learning. • The app's pronunciation and speaking exercises may not provide enough opportunities for users to practice and receive feedback on their oral skills.

In summary, each application has its unique strengths and weaknesses. Sudoku and Word Collect provide mental challenges with potential drawbacks of repetition and productivity loss, respectively. Duolingo excels in making language learning engaging but may face challenges with monotony in exercises. Users' preferences may guide their choice based on these factors.

2.7 Comparison of Similar Systems and Own System

Duolingo and CyberShield" are distinct educational platforms leveraging gamification to enhance learning experiences. While Duolingo focuses on language acquisition through bite-sized lessons and interactive stories, "CyberShield" tackles cybersecurity challenges with engaging scenarios and quizzes. Both platforms aim to make learning enjoyable and effective, catering to diverse audiences in their respective domains. Table 2.7 Comparison of Similar Systems and Own System.

Table 2.7 Comparison of Similar Systems and Own System

Application			
Primary Function	Learn Language	Logic Puzzle	Teach Cybersecurity
Interactive Challenges	No	No	Yes (Branching narrative)
Storyline	Yes (Loose narrative)	No	Yes (Branching narrative)
Unlockable Content	Yes (New lessons)	No	Yes (New challenges, topics)
Adaptive Learning	No	No	Yes

Overall "CyberShield," an innovative computer game developed to address the growing cybersecurity challenges, offers an engaging and educational solution for users of all ages. The primary research objective is to assess its impact on improving cybersecurity awareness and behavior. The game, created through collaboration with game developers, cybersecurity experts, and instructional designers, features interactive scenarios, knowledge-testing quizzes, and a compelling storyline guiding players through cybersecurity challenges. In summary, "CyberShield" is designed to be an interactive and effective tool for raising cybersecurity awareness and promoting safe online behaviors. The research methodology ensures a comprehensive evaluation, making it a promising initiative in addressing the critical issue of cybersecurity readiness in our digital world.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This section outlines the comprehensive research design and methodology employed to assess the impact of the cybersecurity game on participants' knowledge and behavior. A blended methodology is adopted, encompassing surveys and data analysis to scrutinize participant engagement with the game. The incorporation of diverse research strategies aims to provide an in-depth evaluation of how the game influences cybersecurity awareness across various demographics and knowledge levels.

In addition to surveys and quantitative analysis, this mixed-methods approach integrates qualitative interviews to delve into the intricacies of participants' experiences with the cybersecurity game. Through these interviews, we seek to uncover the subtle nuances in decision-making processes, shedding light on underlying factors that may contribute to changes in cybersecurity awareness and behavior. The synergistic combination of quantitative data from surveys and qualitative insights from interviews enhances the reliability and validity of our research findings.

Our multifaceted methodology is designed to ensure a robust evaluation of the game's impact on participants, offering valuable contributions to the field of cybersecurity education. By engaging individuals from diverse backgrounds and expertise levels, we aim to provide a comprehensive understanding of the game's effectiveness in fostering cybersecurity knowledge and influencing behavior. This holistic approach will enable us to draw meaningful conclusions and contribute significant insights to the broader realm of cybersecurity education.

3.2 Software Development Methodology

Software development methodologies provide structured approaches to guide the process of creating and delivering software systems. Software development methodologies are systematic frameworks that prescribe processes, activities, and best practices for efficiently developing high-quality software. These methodologies encompass various stages, such as planning, design, developing, testing, and deployment, ensuring a well-organized and streamlined development lifecycle. They contribute to project success by enhancing collaboration, managing resources effectively, and minimizing risks throughout the software development process.

3.2.1 Types of Software Development Methodologies

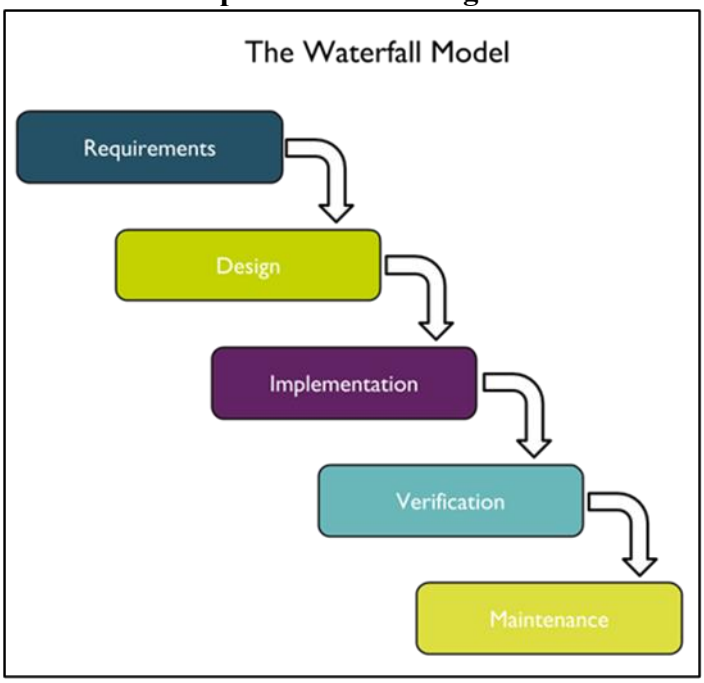


Figure 3.2.1: Waterfall Model

The Waterfall Model, with its sequential phases, ensures a systematic progression through requirements, design, implementation, testing, and maintenance. The Waterfall Model promotes a linear and step-by-step software development approach, where each phase must be completed before moving to the next. This methodology emphasizes thorough documentation, enabling clear project tracking and facilitating easier identification and resolution of issues. Its structured nature suits projects with well-defined and stable requirements.

Figure 3.2.2: Agile Methodology

Agile Methodology, including Scrum and Extreme Programming, focuses on collaboration and iterative development to quickly adapt to changing requirements. Scrum, within Agile, uses short sprints for incremental development. Extreme Programming emphasizes customer involvement and practices like pair programming. Lean Development aims to eliminate waste and improve efficiency. Agile methodologies like Scrum and Extreme Programming prioritize customer feedback, fostering flexibility in adapting to evolving project requirements. Scrum employs regular sprint cycles for iterative progress, enhancing adaptability. Extreme Programming emphasizes continuous customer engagement and innovative practices such as pair programming, fostering robust software development. Lean Development further focuses on waste reduction and efficiency optimization for streamlined project delivery.

Rapid Application Development (RAD) emphasizes rapid prototyping and user feedback. The Spiral Model integrates risk analysis into iterative cycles. Prototype Methodology involves creating prototypes for refining requirements. Rapid Application Development (RAD) accelerates software development through quick prototyping and continuous user feedback, fostering agile responsiveness. The Spiral Model integrates risk assessment

seamlessly into iterative development cycles, allowing for adaptive adjustments. Prototype Methodology focuses on creating early-stage models to iteratively refine and enhance project requirements, facilitating a collaborative and user-centric approach.

DevOps fosters collaboration between development and operations teams. Continuous Integration/Continuous Delivery (CI/CD) automates frequent software releases. These methodologies equip developers with diverse tools and philosophies to address the complexities of software development, ensuring effective project management and successful system delivery. DevOps integrates development and operations workflows, promoting faster development cycles and improved software quality. CI/CD automation testing and deployment, enhancing the reliability and efficiency of software releases. With an emphasis on communication and automation, these methodologies enable teams to respond swiftly to changes, reducing time-to-market and enhancing overall software development productivity.

3.3 Chosen Methodology and Justification

Agile methodologies represent a dynamic and iterative approach to software development, prioritizing adaptability and customer collaboration. Rooted in the Agile Manifesto's principles, these methodologies, such as Scrum and Kanban, emphasize incremental progress, regular feedback, and a flexible response to changing requirements. Agile fosters a collaborative, cross-functional team environment, promoting transparency and delivering customer value in iterative cycles.

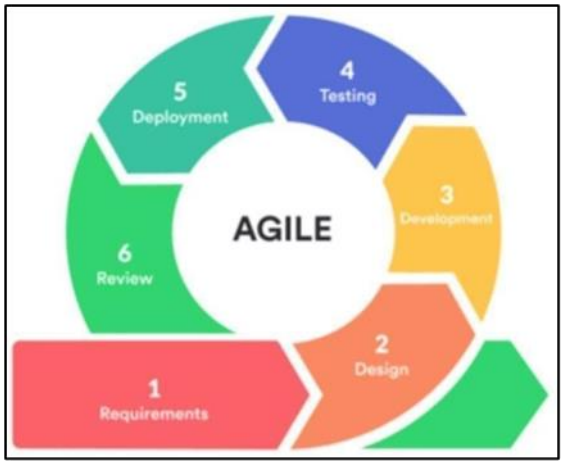


Figure 3.3: Agile Methodology

Based on the explained methodology in the previous section, the Agile approach has been chosen as the preferred development methodology for the "CyberShield" application, owing to its inherent advantages that align seamlessly with the dynamic nature of cybersecurity challenges. Firstly, Agile methodologies foster adaptability, allowing the project team to respond swiftly to emerging cybersecurity threats and evolving client needs. In the fast-paced realm of cybersecurity, where new vulnerabilities and attack vectors constantly emerge, the ability to adapt quickly is paramount. Agile's iterative development process ensures regular feedback loops, enabling continuous refinement of security features based on real-time insights and evolving threat landscapes.

Moreover, the collaborative nature of Agile methodologies promotes effective communication and cooperation between developers and cybersecurity experts. This collaboration is crucial for ensuring a comprehensive and responsive approach to threat mitigation. By breaking down silos and encouraging interdisciplinary teamwork, Agile facilitates the integration of security measures at every stage of development, resulting in a more robust and resilient application.

The incremental delivery of functionalities in Agile development aligns seamlessly with the progressive nature of cybersecurity enhancements. The iterative cycles allow for the frequent release of updates and patches, ensuring that the "CyberShield" application is consistently fortified against emerging threats. This incremental approach not only enhances the application's security posture but

also allows for the integration of new features and technologies as they become available, keeping the application at the forefront of cybersecurity advancements.

In conclusion, Agile methodologies provide the flexibility and responsiveness necessary for the successful development of the "CyberShield" application in the ever-evolving landscape of cybersecurity. The complexity of cybersecurity challenges and the need for constant feedback and adaptation make Agile an ideal choice, enabling the development team to stay ahead of emerging threats and deliver a cutting-edge solution that effectively safeguards against evolving cyber risks. Table 3.3 will provide the justification for the agile methodology.

Table 3.3: Justification for the chosen methodology

Agile Principle	Application in "CyberShield" Game Development
1. Iterative Development	Allows for iterative development with regular increments and releases. - Breaks down game development into manageable tasks for frequent updates and improvements.
2. Flexibility to Adapt	Provides flexibility to adapt to evolving cybersecurity threats. - Incorporates new educational content promptly based on changes in the cybersecurity landscape
3. Collaboration among Cross-Functional Teams	Encourages collaboration between game developers, cybersecurity experts, and instructional designers. - Facilitates effective communication and coordination through regular scrum ceremonies.
4. User-Centric Design	Emphasizes user feedback through regular testing and evaluation. - Ensures early identification of issues and incorporation of user preferences for a game that meets user expectations.
5. Early and Continuous Delivery	Promotes early and continuous delivery of "CyberShield" for quick dissemination of cybersecurity knowledge. - Facilitates staged releases, allowing adjustments based on early user feedback.
6. Risk Management	Provides mechanisms for identifying and mitigating cybersecurity risks promptly. - Regular retrospectives and reviews allow the team to adapt their approach for successful delivery.

In summary, the Agile methodology aligns well with the dynamic nature of game development and the evolving field of cybersecurity. It facilitates collaboration, flexibility, and a user-centric approach, ensuring that "CyberShield" is not only effective in addressing cybersecurity challenges but also responsive to the needs of its users.

3.3.1 Step by Step Explanation of Phases the Chosen Methodology

The chosen methodology for developing the cybersecurity educational game follows a structured approach to ensure the creation of an engaging and effective learning tool. Each phase of the process involves specific inputs, detailed processes, and clear outputs. The following table 3.3.1 provides a step-by-step overview of each phase, highlighting the collaborative efforts and iterative testing involved in delivering a high-quality educational experience.

Table 3.3.1 step-by-step process for each phase

Input	Process	Output
Design Phase	Collaborative planning involving cross-functional teams, outlining game features, scenarios, quizzes, and storyline.	Detailed game design document, featuring educational objectives and engaging cybersecurity challenges
Testing Phase	Concurrent testing and development, continuous testing of implemented features, user testing for feedback.	Bug identification, user feedback, and insights for usability and engagement improvements.
Deployment Phase	Incremental release of the product, making the game available to participants.	Regularly deployed game increments, assessing impact on cybersecurity awareness in real-world scenarios.
Feedback Phase	Gathering and analyzing feedback through post-game surveys and focus group discussions	Insights into player experiences, identification of areas for improvement, and refinement for subsequent iterations.

3.3.2 Design Phase

In the Design Phase of the "CyberShield" game development using the Agile methodology, the emphasis lies on collaborative and iterative planning. Cross-functional teams, consisting of game developers, cybersecurity experts, and instructional designers, work closely to outline the game's features, interactive scenarios, quizzes, and storyline. This phase encourages flexibility, allowing the team to adapt to emerging ideas and insights. Continuous feedback loops are established to ensure that the game aligns with the educational objectives and engages players effectively in addressing cybersecurity challenges. The iterative nature of Agile allows for ongoing refinement of the game's design based on collaborative discussions and evolving requirements.

3.3.3 Testing Phase

Moving to the Testing Phase, Agile principles encourage concurrent testing and development. As features are implemented, the game undergoes continuous testing, ensuring that each component functions as intended. This iterative testing process not only identifies bugs early but also facilitates the incorporation of user feedback and improvements promptly. By conducting user testing with a diverse group of potential players during this phase, the development team can gather valuable insights into the game's usability and engagement. This iterative testing and feedback process is essential for refining the game's design and ensuring it meets both educational and gaming objectives.

3.3.4 Deployment Phase

The Deployment Phase in Agile involves releasing increments of the product regularly. In the context of "CyberShield," this means making the game available to participants for a defined period. This incremental deployment allows the team to assess the impact of the game on cybersecurity awareness and behaviour in real-world scenarios. Agile's emphasis on continuous delivery enables the team to respond to emerging needs and insights during the deployment, ensuring a more adaptive and user-centric approach.

3.3.5 Feedback Phase

Following deployment, the Feedback Phase in Agile focuses on gathering and analyzing feedback from players. Post-game surveys and focus group discussions are conducted to understand the players' experiences and perceptions. This feedback is crucial for identifying areas of improvement, addressing any issues that may have emerged during deployment, and refining the game for subsequent iterations. The Agile approach to feedback emphasizes a continuous learning process, fostering an environment where the game evolves based on user input and changing cybersecurity landscapes.

3.4 Research Methodology

In any research endeavor, the selection of an appropriate research methodology plays a pivotal role in shaping the trajectory of the study. The chosen methodology serves as a guiding roadmap, influencing the study's design, data collection, analysis, and interpretation processes. Researchers typically categorize methodologies into three main types: qualitative, quantitative, and mixed methods. Qualitative research delves into understanding and exploring social phenomena in depth through open-ended questions, interviews, and observations. On the other hand, quantitative research emphasizes the measurement and analysis of numerical data to test hypotheses and make predictions. The third category, mixed methods, combines both qualitative and quantitative approaches to offer a more comprehensive understanding of the research topic. The careful consideration and justification for selecting a specific methodology are crucial, particularly in the context of the "CyberShield" game application project. This decision will significantly impact the ability to effectively address the research objectives, which revolve around evaluating the game's impact on enhancing cybersecurity awareness and behavior.

Research methodology encompasses a systematic approach and techniques used to conduct research, encompassing the design, collection, analysis, interpretation, and presentation of findings. The nature of the research topic and the study's objectives dictate whether a qualitative, quantitative, or mixed methods

approach is most appropriate. Qualitative methods are well-suited for exploring complex social phenomena, relying on open-ended inquiries and qualitative data sources. Quantitative methods, on the other hand, are employed for measuring and analyzing numerical data to test hypotheses. Mixed methods research combines both approaches, allowing researchers to gain a more holistic understanding of the subject matter. In the case of the "CyberShield" game application project, thoughtful consideration and justification for the chosen methodology are imperative to ensure that the research approach aligns with the specific objectives of evaluating the game's impact on cybersecurity awareness and behavior.

Table 3.4 Comparison of Research Methodology

Aspect	Qualitative Research	Quantitative Research	Mixed Methods Research
Focus	Understanding and exploring social phenomena in depth	Measuring and analyzing numerical data to test hypotheses	Combining both qualitative and quantitative approaches for a comprehensive understanding
Data Collection Methods	Open-ended questions, interviews, observations, focus groups	Structured questionnaires, surveys, experiments	Variety Of methods, including surveys, interviews, observations
Data Analysis	Coding, thematic analysis to identify patterns and themes	Statistical methods (regression analysis, t-tests)	Both qualitative and quantitative techniques
Emphasis	Subjective experiences and context	Objectivity and generalizability	Utilizing strengths of both approaches, triangulation
Presentation of Findings	Narrative descriptions, quotes	Tables, charts, graphs	Integration of qualitative and quantitative results

3.4.1 Chosen Research Methodology and Justification

The chosen mixed methods research design, incorporating both qualitative and quantitative approaches, ensures a comprehensive evaluation of the "CyberShield" game's impact on cybersecurity awareness and behavior. The qualitative component, employing open-ended questions, interviews, and focus groups, captures nuanced subjective experiences and contextual details, providing depth to the understanding of players' engagement. Simultaneously, the quantitative aspect, utilizing structured questionnaires, surveys, and gameplay analytics, gathers numerical data on knowledge levels and behavioral patterns. This combination allows for triangulation, enhancing the study's validity by comparing findings from diverse data sources. The integration of narrative descriptions, quotes, and visual elements in presenting the results ensures a holistic representation, striking a balance between qualitative insights and quantitative rigor, thus offering a nuanced and robust assessment of the game's impact on cybersecurity awareness and behavior. Table 3.4.1 represent qualitative methods and table 3.4.2 represent quantitative methods.

Table 3.4.1 Qualitative Methods

Component	Data Collection Methods	Benefits for the Study	Data Analysis
Open-ended questions	Surveys/questionnaires with open-ended items	Captures rich, in-depth insights into player experiences	Thematic analysis to identify recurring patterns/themes
Interviews	One-on-one interviews with participants	Provides a deeper understanding of individual experiences	Content analysis to extract key themes and patterns
Focus groups	Group discussions with players	Facilitates exploration of shared experiences and opinions	Content analysis to identify common themes and trends

Table 3.4.2 Quantitative Methods ✓

Component	Data Collection Methods	Benefits for the Study	Data Analysis
Structured questionnaires	Surveys/questionnaires with closed-ended items	Gathers numerical data on specific aspects of player behavior	Descriptive statistics to summarize and analyze responses
Surveys	Online or paper-based surveys	Collects data on participants' knowledge levels and perceptions	Quantitative analysis to identify trends and patterns
Gameplay analytics	Tracking in-game user actions and decisions	Measures quantitative indicators of player behavior	Statistical analysis to assess correlations and trends

check space

3.4.2 Questionnaire Design and Samples

To effectively gather feedback on the "CyberShield" Educational Game Application, the survey design should adhere to specific criteria and consider various variables. Firstly, the questionnaire must be relevant to the survey's purpose, ensuring that questions directly address aspects like game display, interface, gameplay, educational elements, and overall satisfaction. Clarity is crucial, necessitating easily understandable questions, while a commitment to unbiased inquiry precludes leading questions that might influence responses. A comprehensive approach is warranted to cover all pertinent facets of the game. Additionally, respondents should be assured of the confidentiality of their feedback, emphasizing that it will solely be utilized for research purposes.

Several key variables must be considered within the survey framework. Game display encompasses graphics quality, visual appeal, colour schemes, and creativity. Interface variables should evaluate ease of navigation, intuitiveness, and overall user-friendliness. The survey should delve into educational elements, exploring the incorporation of educational content, its relevance to the target age group, and the level of engagement it fosters. Overall satisfaction, capturing respondents' feelings about the game holistically, should include aspects such as enjoyment, challenges, and rewards.

In terms of sample data collection, a sample size of 50 people has been determined, with surveys to be conducted at SMK(F) Palong 2,73450 Gemas, Negeri Sembilan and SK(F) Palong 2,73450 Gemas, Negeri Sembilan. The individuals tasked with survey administration are Muhammad Zainudin bin Ahmad and Noor Fatin binti Mohd were chosen for their roles as school counselors. As school counselors, they are familiar with the students and are well equipped to conduct the survey in a manner that is comfortable and familiar for the participants. Ethical considerations are paramount, emphasizing the confidentiality of responses and the responsible use of collected data for research purposes. Upon completion of the survey, the data will be meticulously analyzed to derive meaningful insights for the overarching research project. The approval to conduct the survey at SMK(F) Palong and SK (F) Palong was obtained by seeking assistance from the school principal. The purpose of their involvement is to ensure that the survey is conducted in a professional, ethical, and sensitive manner, taking into account the well-being and confidentiality of the participants. This approach aims to create a conducive environment for gathering valuable feedback on the "CyberShield" Educational Game Application.

3.4.3 Analysis of Questionnaire Data

Upon receiving the survey results, the analysis of the questionnaire data involves a systematic approach encompassing several key processes and methods. The sample data collection will involve surveys conducted at SMK(F) Palong and SK (F) Palong, with a determined sample size of 50 people. The survey administration will be carried out by Muhammad Zainudin bin Ahmad and Noor Fatin binti Mohd, chosen for their roles as school counselors due to their familiarity with the students and ability to conduct the survey in a comfortable and familiar manner. Ethical considerations, including the confidentiality of responses and responsible use of collected data, are paramount.

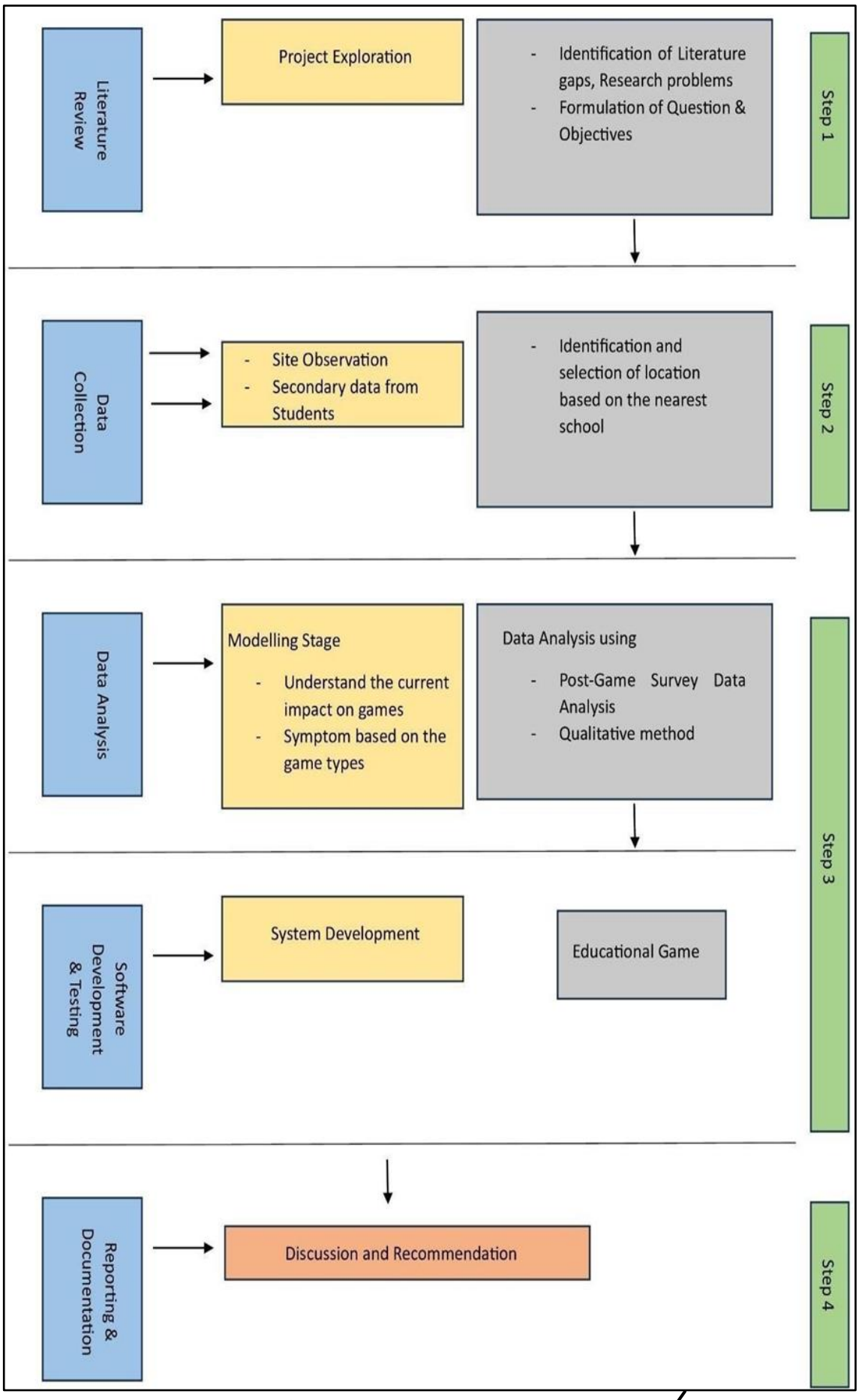


Figure 3.4.3 Analysis of Questionnaire Data ✓

The project methodology is structured into four distinct stages. The first stage, known as Project Exploration, involves identifying gaps in the existing literature, defining research problems, and establishing objectives. Moving on to the second stage, data collection is conducted through site observations, interviews, and gathering secondary data from students. The primary aim of this stage is to gain a comprehensive understanding of the educational game application's significance. Stage 3 is divided into two parts. Part 1 involves analyzing the data obtained through post-game surveys, while Part 2 focuses on Software Development and Testing, resulting in the creation of the "Educational Game" system. Finally, Stage 4 encompasses reporting and documentation, followed by a thorough discussion and recommendations based on the findings.

3.4.4 Proposed System Requirement

The Proposed System Requirements outline the key functionalities and attributes that will be integrated into the "CyberShield" educational game application. These requirements are designed to ensure that the application delivers an engaging, educational, and secure platform for users to enhance their cybersecurity awareness and skills while promoting safe online behaviors. The following section delineates both functional and non-functional requirements essential for the development and implementation of CyberShield.

✓

3.4.4.1 Functional Requirements

1. User Registration and Profiles: The system should allow users to create and manage their profiles, including progress tracking and achievements within the game.

2. Interactive Scenarios: The application must provide interactive scenarios that simulate real-world cybersecurity challenges, requiring users to make decisions to protect their virtual identity.

3. Educational Quizzes: The game should include quizzes to test users' knowledge of cybersecurity concepts and best practices, offering immediate feedback to reinforce learning.
4. Storyline Guidance: Incorporate a compelling storyline that guides players through various cybersecurity challenges, ensuring an engaging and educational gaming experience.
5. User Feedback Mechanism: Implement a system for users to provide feedback on the game's effectiveness in conveying cybersecurity concepts and promoting behavioral changes.

3.4.4.2 Non-functional Requirements

1. Security: The application must adhere to stringent security standards to safeguard user data and ensure a secure gaming environment.

2. Performance: The game should offer seamless performance across various devices and network conditions to provide an optimal user experience.
3. Scalability: The system should be designed to accommodate a growing user base and potential future enhancements to the game's features.
4. Usability: Ensure the game's interface is intuitive and user-friendly, catering to individuals of all ages and varying levels of technical proficiency
5. Accessibility: The application should be designed to be accessible to users with disabilities, adhering to relevant accessibility guidelines and standards.

By integrating these functional and non-functional requirements, the "CyberShield" educational game application aims to provide an engaging, educational, and secure platform for users to enhance their cybersecurity awareness and skills while promoting safe online behaviors.

3.5 Tools and Hardware

Provides an overview of the software tools and hardware components relevant to the development environment. It encompasses essential tools utilized in software development, such as integrated development environments (IDEs), programming languages, and other hardware resources necessary for efficient and effective development processes. This section aims to highlight the key tools and hardware components essential for developers to create, test, and deploy software applications across different platforms and devices.

3.5.1 Software

Figure 3.5.1.1: Android Studio Code

Android Studio, commonly referred to as AS Code, is a software developed by Google utilizing the IntelliJ IDEA platform. It serves as an integrated development environment (IDE) specifically tailored for Android app development. Compatible with Windows, Linux, and macOS operating systems, its features include debugging assistance, syntax highlighting, intelligent code suggestion, code snippets, code restructuring, and integrated version control with Git.

BACKEND

Figure 3.5.1.2: Java

Java is a widely-used, high-level programming language renowned for its portability and versatility. It emphasizes object-oriented programming principles and is statically typed. Java is extensively used for building a variety of applications, from desktop to mobile and enterprise-level systems. Its features include automatic memory management through garbage collection, robust exception handling, and a vast ecosystem of libraries and frameworks supporting diverse programming paradigms.

3.5.2 Hardware

Figure 3.5.2.1: Laptop

Brand	:	ASUS
Series	:	Vivobook
Screen Size	:	15.6 inches
Hard Disk Size	:	512 GB
CPU Model	:	Intel Core i3
RAM Memory Installed Size	:	4.00 GB
Operating System	:	Windows 11 Home
Special Features	:	AI Noise Canceling
Card Description	:	Intel Iris
Graphics Coprocessor	:	Intel Iris Xᵉ Graphics

Figure 3.5.2.2: Handphone for display content

Screen Size	:	6.51 inch
Brand	:	Vivo
RAM	:	4GB
Operating System	:	Funtouch OS 12 (Android 12)

Table 3.5.2 Component used in project

Component	Description
Laptop	A laptop for running the CyberShield Game Application
Smartphone	To display and run the application
Storage	Adequate storage space to store data uploaded
Internet Access	Require internet access the application in phone

3.6 Proposed System Design

The proposed system design for the "CyberShield" educational game app incorporates several key UML diagrams. The Use Case Diagram illustrates the interactions between players and the game administrator, outlining essential functions such as login, gameplay, and score viewing. The Class Diagram presents the relationships and attributes of core system classes, including Player, Game Administrator, and various game components. The Sequence Diagram outlines the

flow of events when a player starts the game, interacts with scenarios and quizzes, and the system's response to their actions. Additionally, an Activity Diagram visually represents the player's journey through gameplay, from login to scenario and quiz interaction, providing a clear depiction of the game's operational workflow. The Component Diagram outlines the various elements of the game, including the client-side user interface, server-side logic, and database integration, while the Deployment Diagram illustrates the physical deployment of the game on different platforms and its connection to the database for user profiles and feedback. Together, these UML diagrams offer a comprehensive understanding of the "CyberShield" game app's structure, behaviour, and system architecture.

3.6.1 UML Modeling of the Proposed System

Unified Modeling Language (UML) serves as a powerful tool for visualizing, specifying, constructing, and documenting the artifacts of a software system. In the context of the proposed system, UML modeling becomes a pivotal aspect of the development process, offering a standardized and comprehensive approach to communicate and understand the system's architecture and design. Through a set of standardized diagrams such as use case diagrams, class diagrams, sequence diagrams, and more, UML enables stakeholders to gain a holistic view of the system's functionalities, relationships, and behavior. This modeling technique facilitates effective communication among developers, designers, and other project stakeholders, ensuring a common understanding and streamlined collaboration throughout the entire software development life cycle. By employing UML modeling for the proposed system, complexities are abstracted, and intricate design details are represented in a visually intuitive manner, fostering a systematic and organized approach to the development process.

3.6.2 Use Case Diagram and Explanation

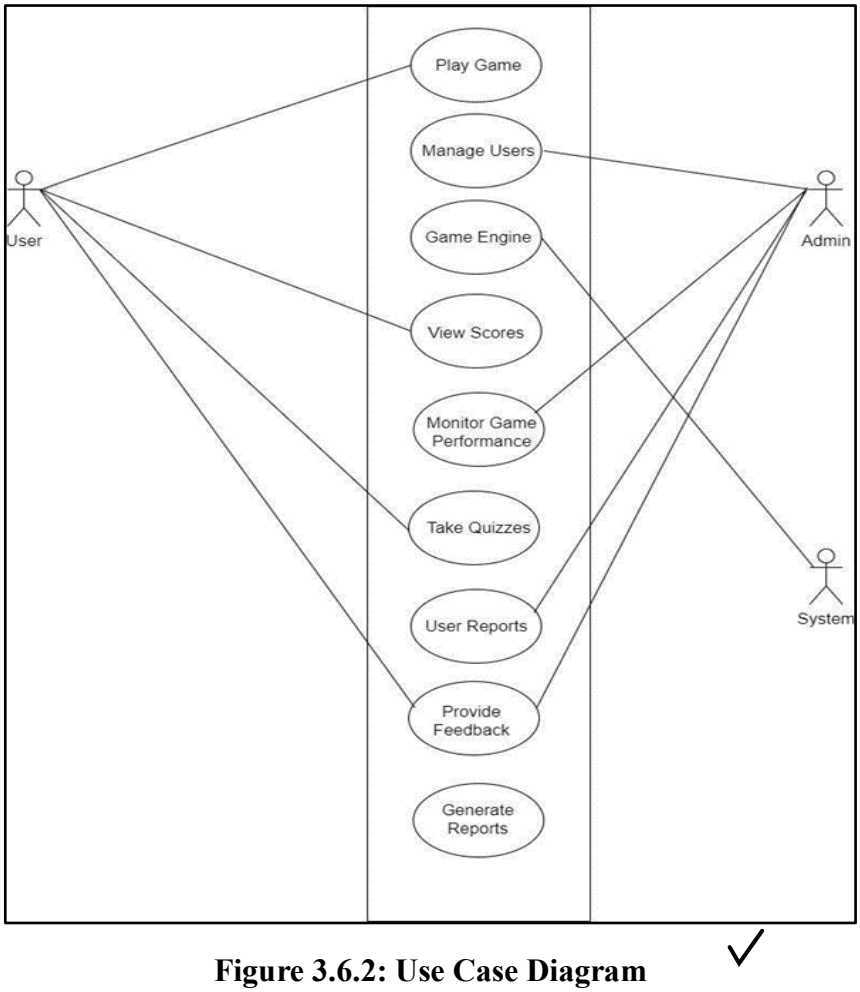


Figure 3.6.2: Use Case Diagram

The picture shows how a gaming app works. There are three main parts: 'User' for people playing games, 'Admin' for those in charge, and 'System' for outside things that work with the app. People using the app can do different things like playing games, checking scores, taking quizzes, and giving feedback to help make the app better. The 'Admin' does tasks like managing users, checking how the games are doing, and getting reports for information. Both users and admins also work with the 'Game Engine' for starting games and changing settings. The 'System' connects to 'Generate Reports,' meaning outside systems can get information too. In short, the picture explains how different parts work together in the gaming app, showing what users and admins can do and how they connect with outside systems.

3.6.3 Package Diagram and Explanation

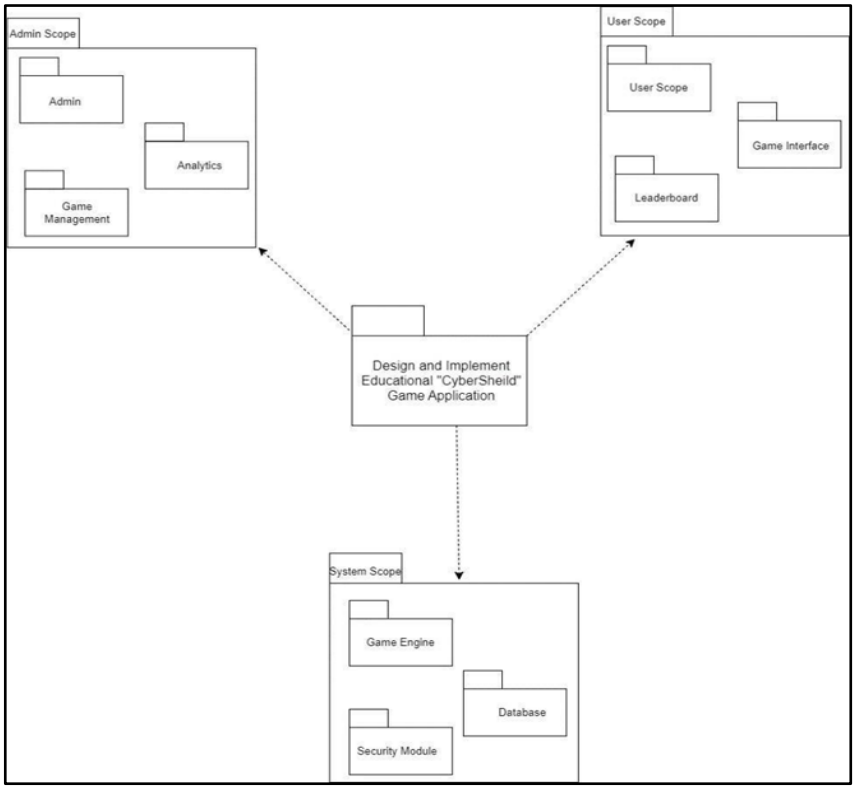


Figure 3.6.3: Package Diagram

The provided image is a package diagram, a component of the Unified Modeling Language (UML), offering a visual representation of the structural organization and dependencies within the "Educational 'CyberShield' Game Application." Three primary scopes define different facets of the application: the Admin Scope, User Scope, and System Scope. Within the Admin Scope, the "Admin" sub-package likely handles user management and application settings, "Analytics" focuses on data analysis tools, and "Game Management" oversees game-related administrative tasks. The User Scope comprises the "Game Interface" for player interaction and a "Leaderboard" for competitive ranking. The System Scope contains core components supporting both Admin and User scopes, such as the "Game Engine" for processing game logic, "Database" for storing game data, and a "Security Module" for safeguarding against unauthorized access. The central package, "Design and Implement Educational 'CyberShield' Game Application," signifies these scopes as integral components, with dotted lines indicating dependency relationships, highlighting the interdependence of these packages in the development of the CyberShield game application.

3.6.4 Class Diagram and Explanation ✓

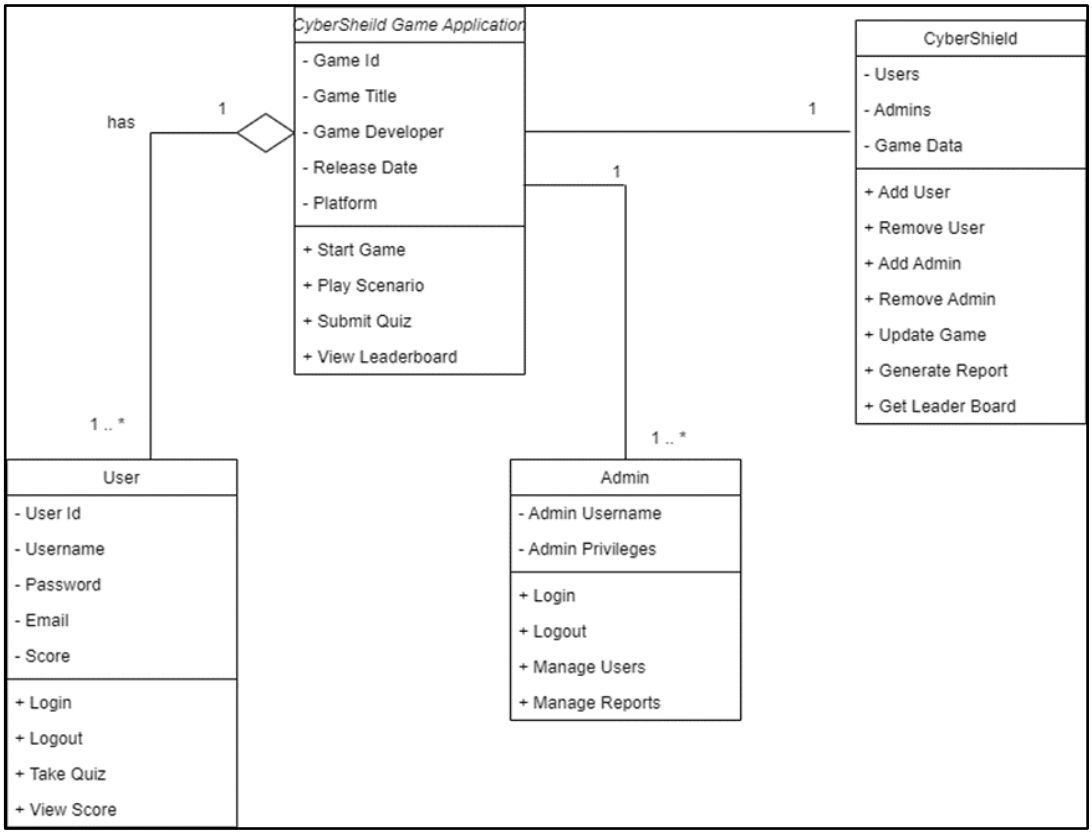


Figure 3.6.4: Class Diagram

The class diagram for the "CyberShield" system provides a comprehensive overview of its static structure, featuring four main classes: "CyberShield Game Application," "User," "Admin," and "CyberShield." Each class is defined by specific attributes and operations, elucidating their distinct roles in the system. For instance, the "CyberShield Game Application" class includes details like Game Id and operations such as Start Game, establishing a "has" association with the "User" class, indicating multiple users for one game application. The "Admin" class, characterized by Admin Username and Manage Users operation, exhibits a one-to-many relationship with the "CyberShield" system, allowing multiple admin instances to be controlled by a single system. The overarching "CyberShield" class orchestrates key functionalities like Add User and Generate Report, featuring a composition relationship with both the "CyberShield Game Application" and "Admin" classes. This design ensures a cohesive system structure, with each class contributing to specific aspects of user interaction, administration, and overall system management within the "CyberShield" framework.

3.6.5 Sequence Diagram and Explanation

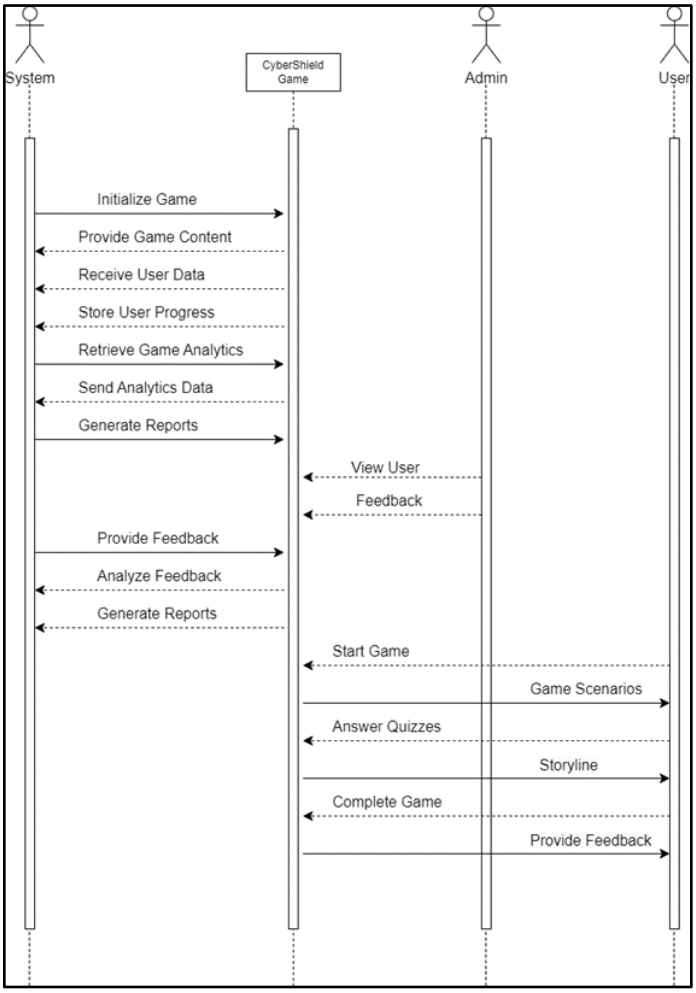


Figure 3.6.5: Sequence Diagram

The presented image constitutes a UML sequence diagram detailing the orchestrated interactions among key entities in the "CyberShield Game" system. Four primary actors are involved: System, CyberShield Game, Admin, and User. The System initializes the game and exchanges data with the CyberShield Game, leveraging this information for analytics, report generation, and feedback provision. The admin interacts with the CyberShield Game, viewing user information and offering feedback. The User engages in the game, progressing through scenarios, quizzes, and storylines, culminating in feedback provision. The diagram employs arrows and lifelines to illustrate synchronous and asynchronous interactions, respectively. This comprehensive representation proves instrumental in elucidating system dynamics, facilitating logic validation, and comprehending real-time or event-driven aspects, pivotal for effective system development and analysis.

3.6.6 Deployment Diagram and Explanation

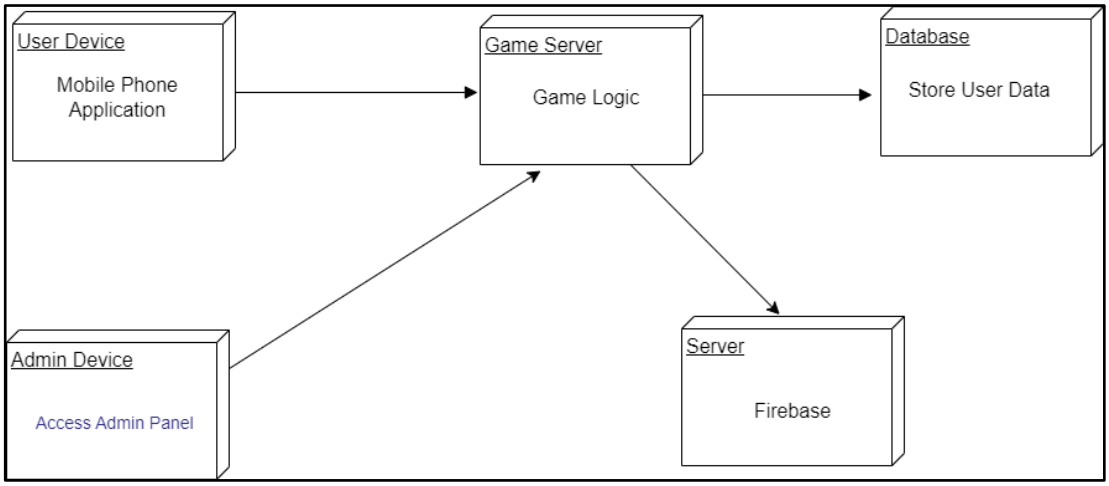


Figure 3.6.6: Deployment Diagram

The deployment diagram delineates the architecture of a mobile gaming application and its backend infrastructure. The "Mobile Phone Application" serves as the user interface, engaging players in the game, with communication directed towards the "Game Server" for processing game logic and managing player interactions. The bidirectional arrow between the Game Server and the "Database" highlights the dynamic exchange of user-specific data, encompassing profiles, game progress, and settings. An "Admin Device" with an "Admin Panel" is incorporated for administrative oversight, interacting with both the Game Server and the "Firebase Server." Firebase, a backend service, is employed for various functionalities, as indicated by arrows connecting the Admin Device and Game Server to Firebase. This diagram provides a comprehensive overview of the mobile gaming application's architecture, delineating the interconnections among the user interface, game server, database, administrative interface, and Firebase backend services, facilitating a holistic understanding of the system's structure and interactions

CHAPTER 4

FINDINGS AND TESTING

4.1 Introduction

In this section, we delve into our innovative approach aimed at enhancing cybersecurity education through the immersive experience provided by the "CyberShield" game application. The development and deployment of this interactive gaming platform, centered on fostering heightened awareness and adeptness in cybersecurity practices, stands as a pivotal component of this endeavor. The research endeavors to gauge the efficacy of this gamified learning tool in bolstering comprehension, engagement, and adherence to cybersecurity protocols through meticulous crafting and assessment.

This research embarks on a journey from conceptualization to execution, employing a blend of qualitative and quantitative methodologies to steer the phases of design, development, and testing. Substantial data accrual is facilitated to inform the developmental trajectory, leveraging student questionnaires and insights garnered from interviews with seasoned cybersecurity experts. The qualitative facet of the research unfolds through in-depth interviews with cybersecurity specialists, unraveling their insights on prevalent challenges within the domain and delineating the merits and demerits of integrating gaming technology into cybersecurity education. Meanwhile, a quantitative approach is adopted through student questionnaires, serving as pillars for the qualitative analyses.

These questionnaires are tailored to elucidate student preferences, learning methodologies, and anticipations regarding the utilization of the "CyberShield" game application in augmenting their cybersecurity awareness and skills. Armed with a nuanced understanding of user perspectives and preferences, coupled with expert insights, the subsequent phases of design and development progress with agility and precision. The culmination of this research effort yields the creation of an immersive and engaging "CyberShield" game application tailored to address identified cybersecurity challenges effectively.

Furthermore, the research elucidates the meticulous testing phase, involving real-world deployment of the "CyberShield" game application in diverse educational settings. Through collaborative engagement with users and cybersecurity professionals, the impact, usability, and efficacy of the game application are rigorously evaluated, offering invaluable feedback for iterative refinement and optimization. In essence, this research offers a holistic approach to cybersecurity education by leveraging gamification principles within the "CyberShield" game application. Through a synergistic blend of qualitative insights and quantitative data, our endeavor seeks to empower users with the knowledge and skills essential for navigating the digital landscape securely, thereby fortifying cyber resilience on a global scale.

4.2 Analysis Findings

The analysis of findings from this study is structured to provide a detailed examination of the research processes and outcomes. The section begins with the insights gained from the pilot study, followed by the comprehensive results of the main data collection. This approach ensures a thorough understanding of both preliminary and primary research phases, facilitating a nuanced interpretation of the data.

4.2.1 Pilot Study

To gain a comprehensive understanding of the methods and protocols preceding the primary data collection, initiating a pilot study was deemed crucial as the initial phase in the research journey. The research methodology involved two primary strategies which are administering a quantitative questionnaire at SMK(F) Palong 2 and SK (F) Palong 2, alongside conducting a qualitative interview with a counseling teacher from SMK(F) Palong 2.

In the qualitative phase of the pilot study, an in-depth interview was conducted with a school counselor from SMK(F) Palong 2. The aim of the interview was to gain insights into the student’s experiences, perspectives, and

challenges regarding cybersecurity education in the school environment. The counselor also provided valuable input on teaching methodologies, identified potential benefits and drawbacks of conventional teaching approaches in cybersecurity, and shared expectations regarding the integration of the "CyberShield" game application into the curriculum. The qualitative data gathered from this interview will serve as a foundational guide for shaping the design and development of the "CyberShield" game application in subsequent phases.

In addition, a sample size of 50 participants has been established, with surveys scheduled to be administered at various educational institutions. Specifically, SMK(F) Palong 2 and SK (F) Palong 2 were identified as representative locations for this study. Participants will be provided with a quantitative questionnaire aimed at gauging their perceptions regarding cybersecurity awareness and their views on the potential efficacy of the "CyberShield" game application. The questionnaire will cover various pertinent topics, including participants' current understanding of cybersecurity concepts, their preferences for interactive learning tools, and their expectations regarding the educational impact of the game. By gathering quantifiable data through the questionnaire, this study aims to gain insights into participants' attitudes and preferences, which will inform the further development and refinement of the "CyberShield" game application to enhance cybersecurity education outcomes. The initial study's results contributed to the improvement of research methods and the formulation of specific approaches to guarantee the effectiveness and significance of the research outcomes.

4.2.2 Result and Findings of Pilot Study

This research delves into the efficacy of the "CyberShield" game application in enhancing cybersecurity awareness and behavior among students at SMK(F) Palong 2 and SK (F) Palong 2. The study involves assessing the impact of the game through interviews with a counselor teacher and a survey administered to 50 students from both schools. The objective is to comprehend the existing challenges, opportunities, and effects associated with integrating the "CyberShield" game into the educational curriculum. By soliciting feedback from teachers and students, particularly regarding their perceptions of cybersecurity education and its engagement level, the study aims to inform the refinement and optimization of the game for effective learning outcomes. Below are the summarized findings obtained from the questionnaire:

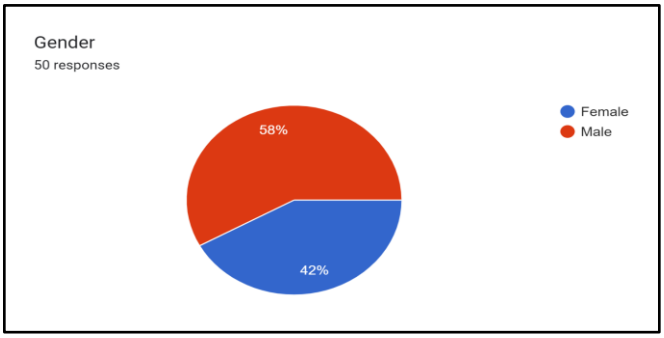


Figure 4.2.2.1: Gender Distribution Among Survey Respondents

The pie chart above illustrates the gender distribution of 50 survey respondents. The chart indicates that the majority of respondents are male, making up 58% of the total, while females represent 42%. This shows a greater representation of males compared to females in the survey.

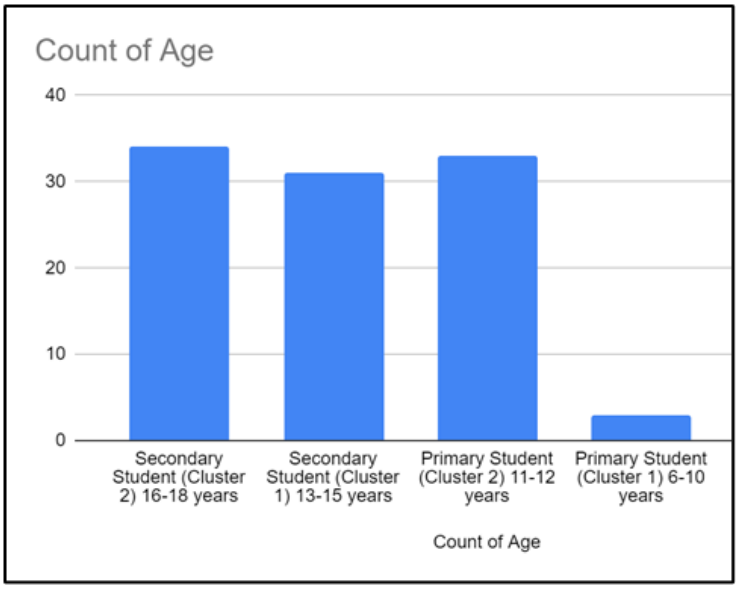


Figure 4.2.2.2: Distribution of Students by Age Clusters

The bar chart above displays the age distribution of students participating in the pilot study, divided into five distinct age clusters. Secondary Students (Cluster 2), aged 16-18 years, have the highest representation with approximately 30 students. Secondary Students (Cluster 1), aged 13-15 years, and Primary Students (Cluster 2), aged 11-12 years, both have around 28 and 30 students respectively. Primary Students (Cluster 1), aged 6-10 years, have the fewest participants at around 3 students.

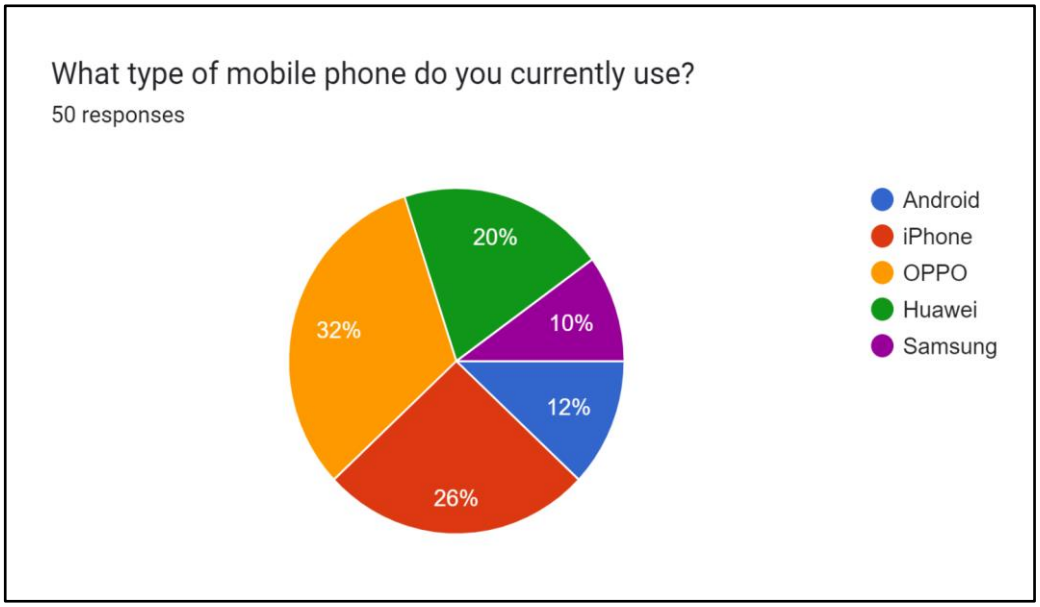


Figure 4.2.2.3: Distribution of mobile phone usage

The pie chart titled "Distribution of Mobile Phone Usage" shows how popular different phone brands are among 50 survey respondents. Oppo is the most popular brand, with 32% of respondents using it. iPhone is the second most popular brand, with 26% of respondents using it. The next most popular brand is Huawei, with 20% of respondents. Finally, Android and Samsung came in last, with only 12% of respondents using an Android phone and 10% of respondents using a Samsung phone.

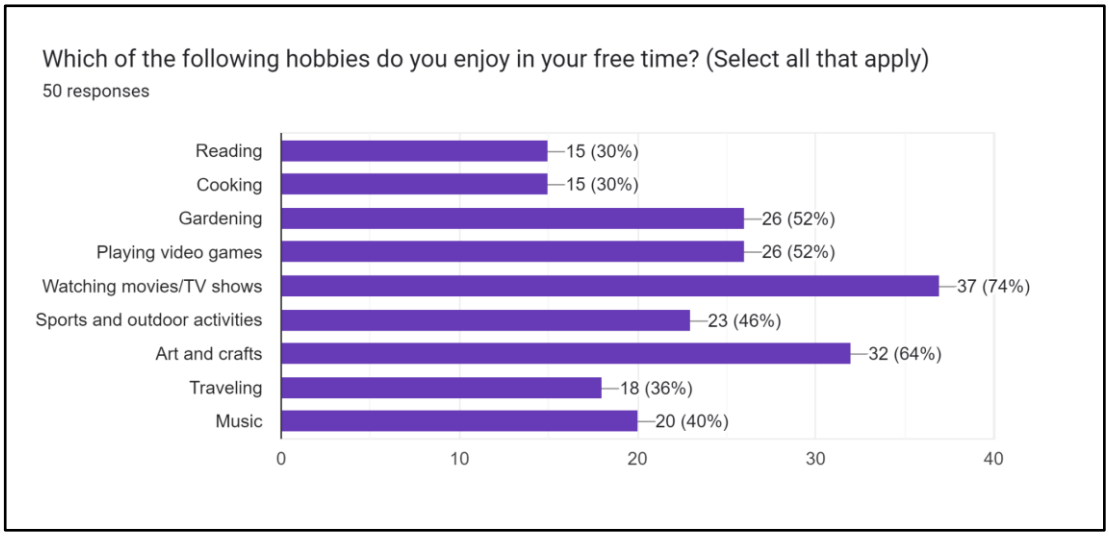


Figure 4.2.2.4: Preferences for recreational activities

The bar chart titled "Preferences for Recreational Activities" depicts the survey results about how people spend their free time. Respondents were able to choose multiple hobbies. Watching movies and TV shows was the most popular activity, selected by 74% of the respondents. Art and crafts were another favorite pastime, selected by 64% of the respondents. Playing video games and Gardening was a close second, with 52% of participants indicating they enjoy it. Sports and outdoor activities were also popular, selected by 46% of the respondents. Other popular choices included music (40%), traveling (36%), and cooking (30%). The fact that the total percentage is greater than 100% highlights that respondents could select multiple hobbies, reflecting the variety of interests people have and how they choose to spend their free time.

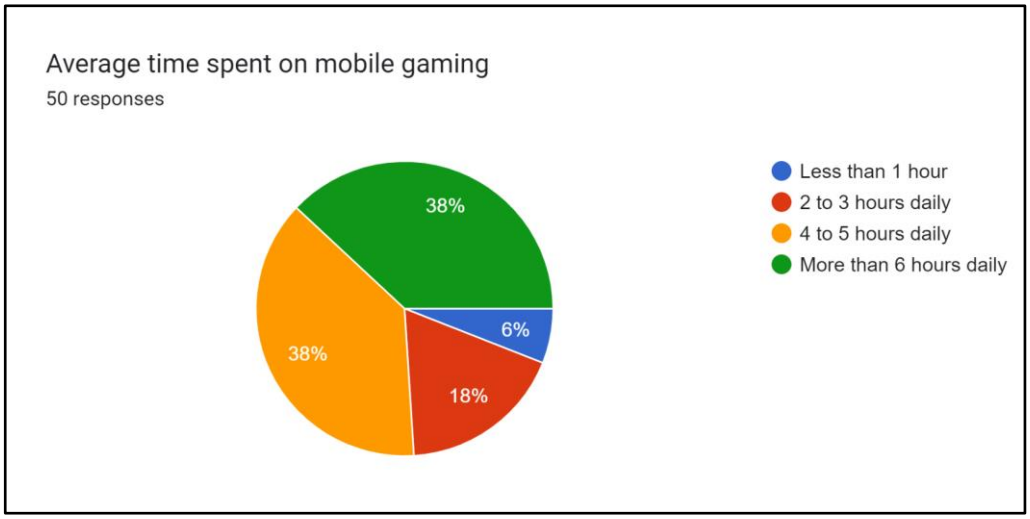


Figure 4.2.2.5: Distribution of average time spent on mobile gaming

The pie chart titled "Distribution of average time spent on mobile gaming" depicts how 50 survey respondents divided their mobile gaming time. The majority, 38%, reported playing games for more than 6 hours daily and playing for 4 to 5 hours a day as shown by the green and yellow section of the pie chart. Around 18% of the respondents, represented by the red slice, indicated playing for 2 to 3 hours daily. A smaller segment, 6%, indicated playing for less than 1 hour a day, according to the blue section. This chart highlights the varied habits people have regarding mobile gaming time.

SECTION B: Game Design and Graphics

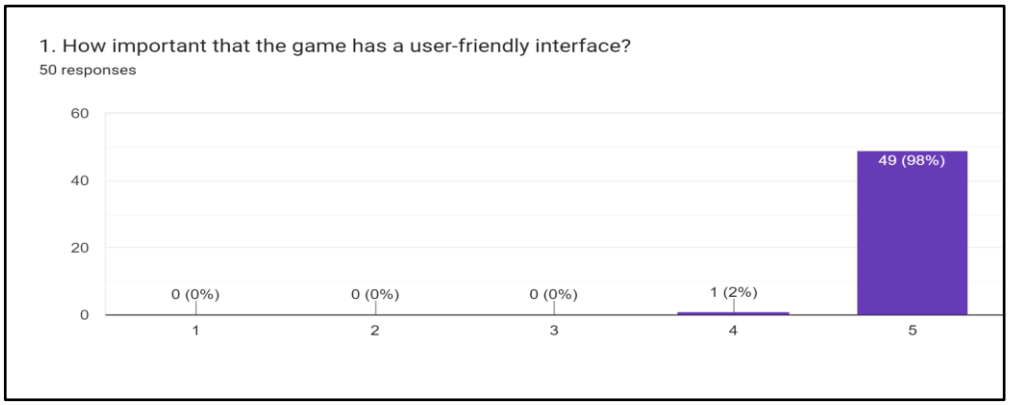


Figure 4.2.2.6: Importance of a User-Friendly Interface in Games

The bar graph shows the results of a survey asking how important it is to have a user-friendly interface in games. Almost all respondents (98%) said it was very important and 2% of respondents said it's important. This suggests that most gamers believe a user-friendly interface is essential for a good gaming experience.

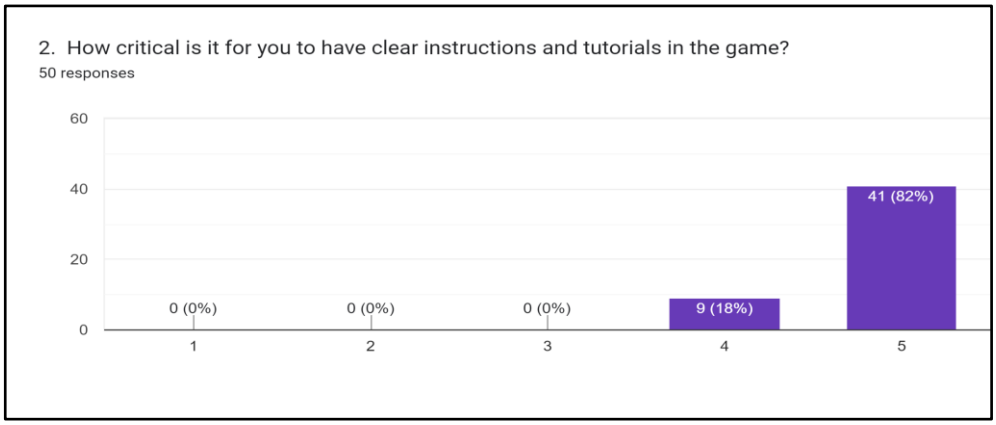


Figure 4.2.2.7: How Critical Are Clear Instructions and Tutorials in Games

The bar chart shows the results of a survey asking how critical it is for players to have clear instructions and tutorials in a game. 82% of respondents said it's very important, with 18% saying it was important. This suggests that most gamers believe clear instructions and tutorials are important for a good gaming experience.

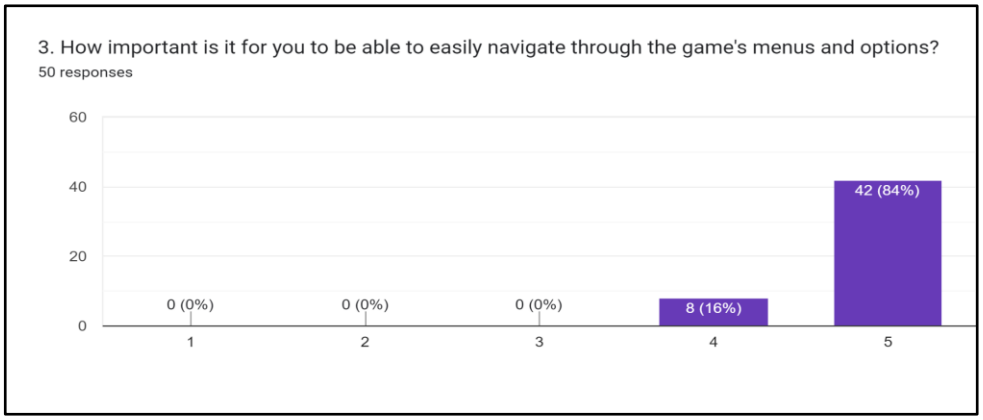


Figure 4.2.2.8: Importance of Easy Menu Navigation in Games

The bar chart shows the survey results on how important it is for players to be able to easily navigate through a game's menus and options. A strong majority (84%) of respondents said it was very important. Only 16% of respondents said it was important. This suggests that most gamers believe easy menu navigation is essential for a positive gaming experience.

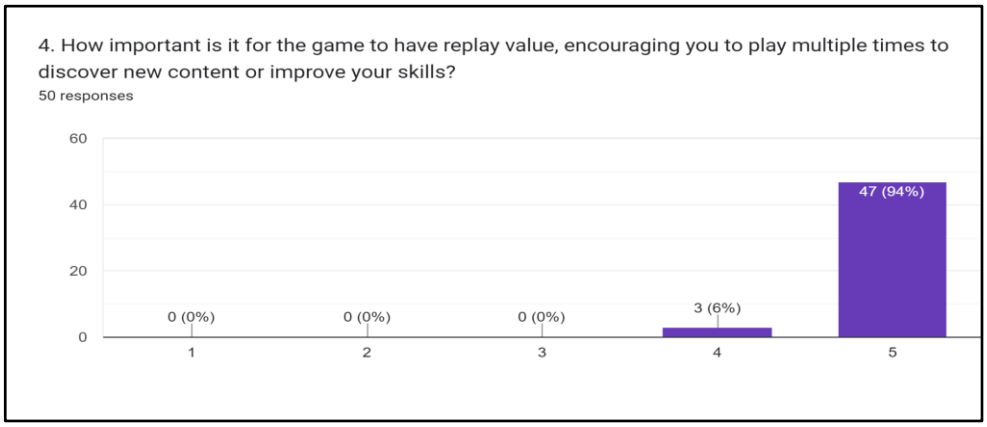


Figure 4.2.2.9: Importance of Replay Value in Video Games

The line graph shows the results of a survey on how important replay value is in video games. Replay value refers to a game's ability to encourage players to play multiple times. Nearly all respondents (94%) said it was very important. Only 6% of respondents said it was important. This suggests that most gamers believe replay value is an important aspect of a video game.

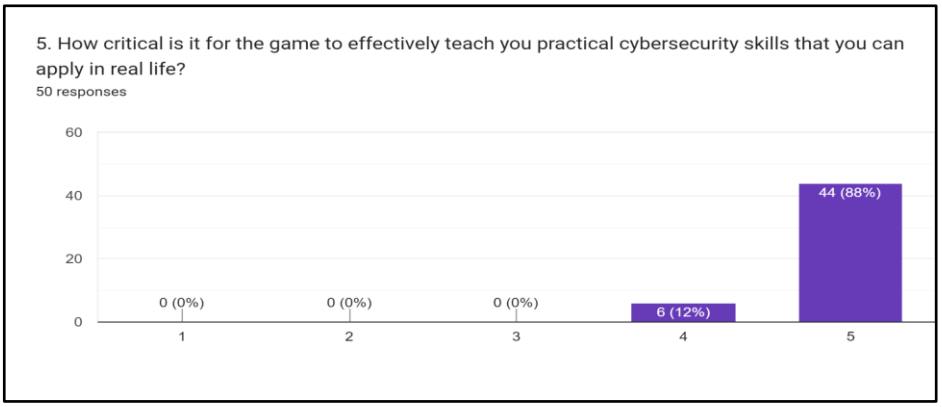


Figure 4.2.2.10: Teaching Practical Cybersecurity Skills Important in Games

The bar chart shows the results of a survey on how important it is for a game to teach players practical cybersecurity skills that they can apply in real life. A strong majority (88%) of respondents said it was very important. Only 12% of respondents said it was important. This suggests that most people believe games can be a valuable tool for teaching cybersecurity skills.

Section C: Game Preferences

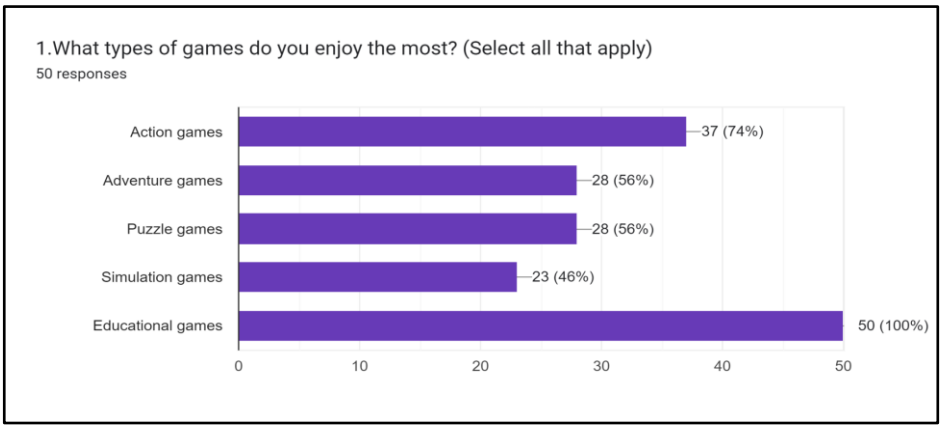


Figure 4.2.2.11: What Types of Games Do People Enjoy the Most

The bar graph shows the results of a survey asking people what types of games they enjoy the most. Respondents were able to choose multiple options. Educational games were the most popular, with 100% of respondents indicating they enjoy them. Action games were the second most popular choice, with 74% of respondents enjoying them. Adventure and puzzle games were tied for third place, with 56% of respondents enjoying each of these types

of games. Simulation games were the least popular choice, but were still enjoyed by 46% of respondents.

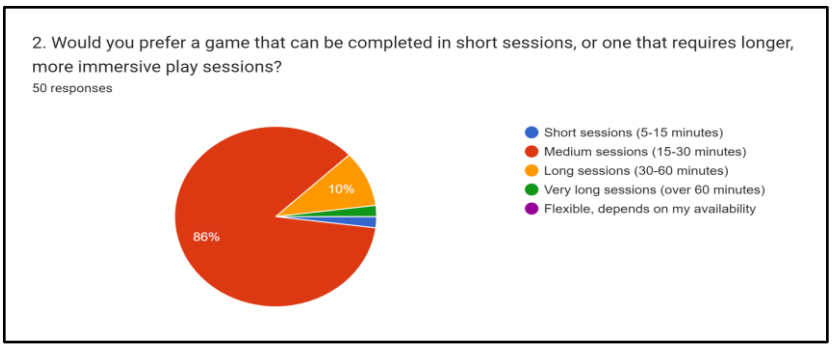


Figure 4.2.2.12: Preferred Play Session Length for Video Games

The pie chart titled "Would you prefer a game that can be completed in short sessions, or one that requires longer, more immersive play sessions?" shows the preferences for video game session lengths among 50 survey respondents. The most popular response (86%) was for games that can be completed in medium sessions (15-30 minutes). Only a small percentage of respondents preferred longer sessions, 10% preferred long sessions (30-60 minutes). Another 2% preferred Very long sessions (over 60 minutes) and short sessions (5-15 minutes) were the least popular choice. The data suggests that most people who participated in this survey prefer to play video games in short bursts.

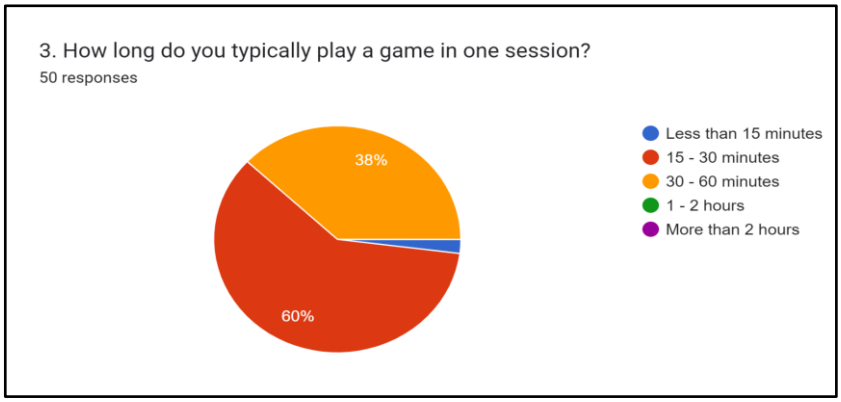


Figure 4.2.2.13: How Long Do People Typically Play Games in One Session ✓

The pie chart titled "How long do you typically play a game in one session?" shows how long people typically play video games in one session. The most popular response (60%) was for sessions lasting 15-30 minutes. Less popular were sessions lasting 30-60 minutes, followed by sessions under 15 minutes (2%) were the least popular choice.

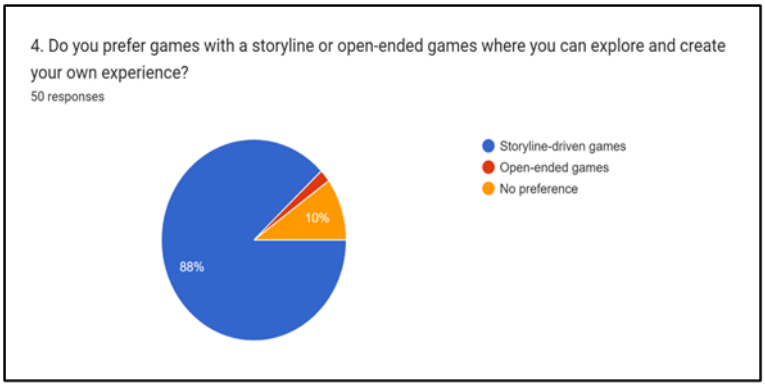


Figure 4.2.2.14: Preference for Storyline-Driven Games vs Open-Ended Games

The pie chart shows the results of a survey asking people about their favorite video game genres. Storyline-driven games were the most popular genre, with 88% of the 50 respondents indicating they prefer this type of game. Open-ended games, where players can explore and create their own experience, were (preferred) by 10% of respondents, and 2% said they had no preference. This suggests that a strong majority of the people who participated in this survey prefer games with a set storyline.

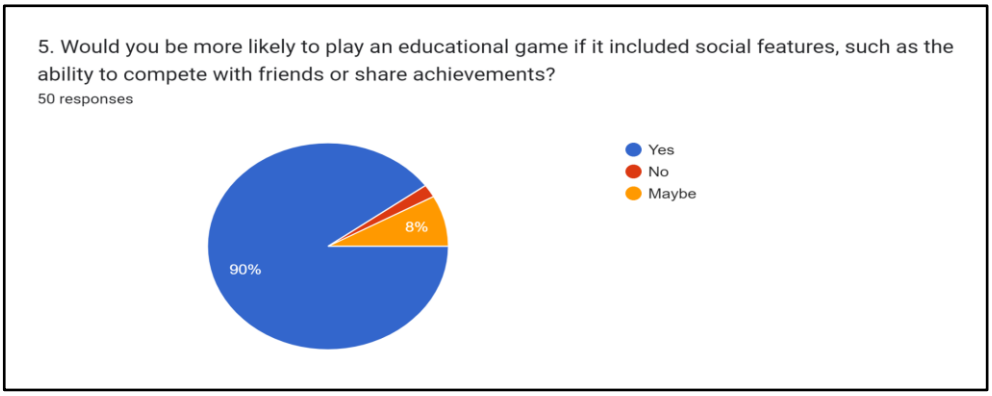


Figure 4.2.2.15: Would Educational Games Be More Appealing with Social Features

The pie chart shows the results of a survey asking whether competition would make educational games more appealing. A strong majority (90%) of the 50 respondents said yes. Only 8% said maybe, and 2% said no. These results suggest that most people believe competition would make educational games more appealing.

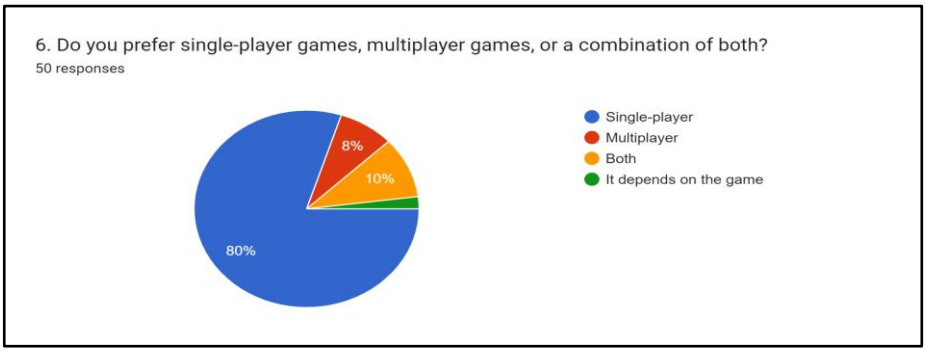


Figure 4.2.2.16: Percentages of People Who Prefer Single-Player, Multiplayer, or Both Gaming Formats

The pie chart shows the results of a survey asking people what video game format they prefer. The survey allowed respondents to choose more than one option. The most popular format, selected by 80% of the 50 respondents, was single-player. Combination of single-player and multiplayer games were the second most popular choice, at 10%, followed by multiplayer games at 8%. These results suggest that most of the respondents enjoy playing as single-player, and it's most preferred.

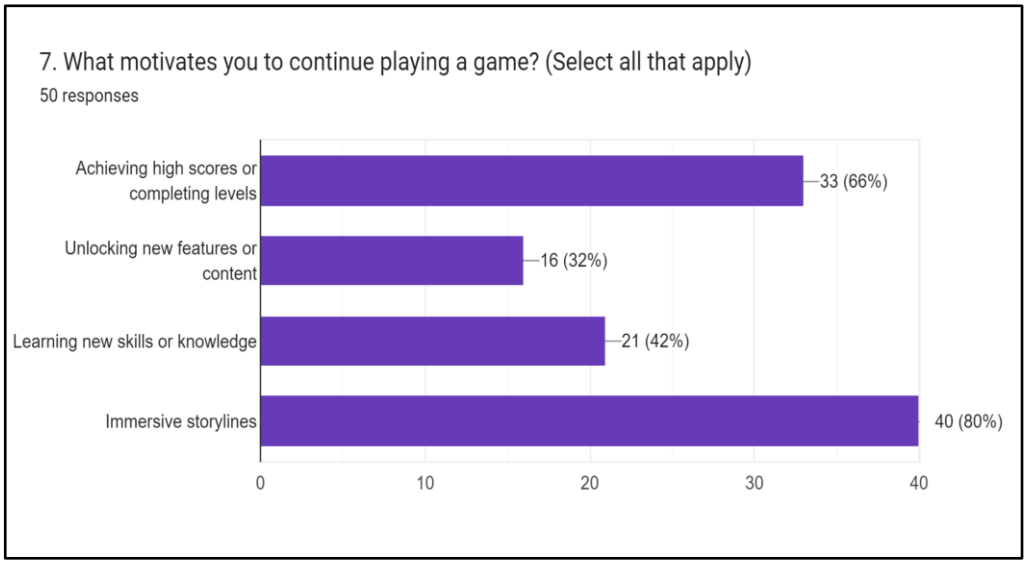


Figure 4.2.2.17: What Motivates People to Keep Playing Games

The bar graph shows the results of a survey asking what motivates people to keep playing games. Respondents could choose multiple options. The most popular motivator was immersive storylines, with 80% of respondents selecting it. Achieving high scores or completing levels was the second most popular motivator, selected by 66% of respondents. Unlocking new features or content was chosen by 32% of respondents, and learning new skills or knowledge was selected by 42%. Overall, the data suggests that people are most motivated to play games by engaging stories and a sense of accomplishment.

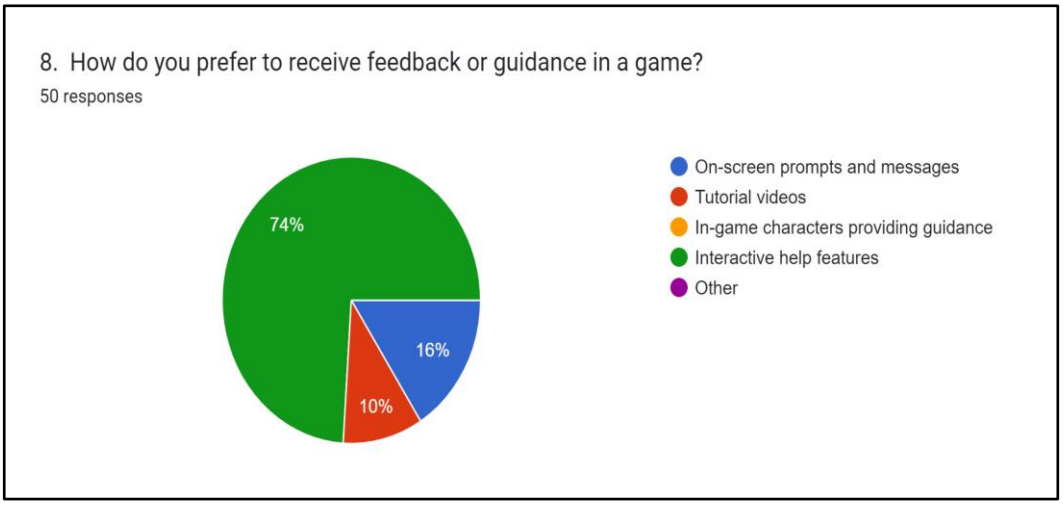


Figure 4.2.2.18: Preferred Methods for Receiving Feedback in Games

The pie chart titled "How do you prefer to receive feedback or guidance in a game?" shows how gamers prefer to receive in-game instruction. Interactive help features are the most popular method, with 74% of respondents selecting this option. On-screen prompts and messages are the second most popular choice, at 16%. Less popular options include tutorial videos (10%) and in-game characters providing guidance with (0%). Other methods account for the remaining 0%. The data suggests that most gamers prefer to receive feedback and guidance directly from in-game characters.

4.3 Testing and Findings

In today's digital age, cybersecurity has become a paramount concern for individuals, organizations, and governments alike. With the increasing complexity and frequency of cyber threats, there is a growing need for effective education and training tools that can equip users with the knowledge and skills to protect themselves and their digital assets. The "CyberShield" game is designed to address this need by offering a comprehensive and engaging platform for cybersecurity education.

By leveraging advanced technology and user-centered design principles, CyberShield aims to revolutionize the way cybersecurity concepts are taught and learned. The game focuses on enhancing accessibility, interactivity, and engagement, making it easier for users to grasp complex cybersecurity topics. Drawing on feedback from both cybersecurity experts and players, CyberShield prioritizes intuitive navigation, engaging visuals, and seamless integration of interactive scenarios and quizzes. These features not only make the learning experience enjoyable but also help users actively engage with the content, leading to better understanding and retention of critical information.

The following section, System Interface, delves into the key design factors, functional requirements, and user experience enhancements that underpin the innovative approach of CyberShield. By examining these elements, we aim to provide a detailed understanding of how the system interface of CyberShield is designed to meet the educational needs of its users and drive innovation in the field of cybersecurity education.

4.3.1 System Interface

By leveraging advanced technology and user-centered design principles, the "CyberShield" game aims to enhance cybersecurity education through increased accessibility, interactivity, and engagement. Incorporating feedback from cybersecurity experts and players, the game prioritizes intuitive navigation, engaging visuals, and seamless integration of interactive scenarios and quizzes. These features enable users to actively engage with cybersecurity content, improving their understanding and retention of critical information. To develop a system interface that revolutionizes education, this subtopic examines the key design factors, functional requirements, and user experience enhancements that drive innovation in the field.

I. Startup Page

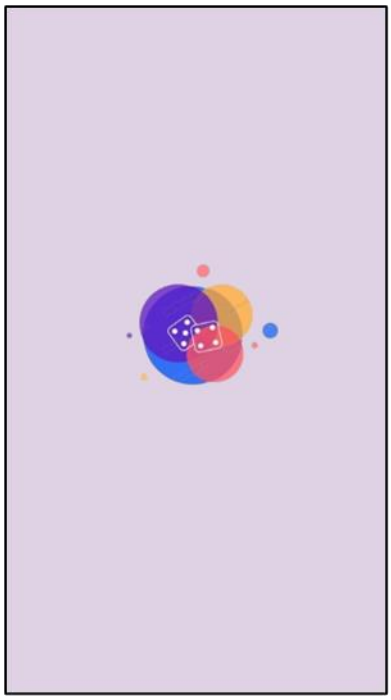


Figure 4.3.1.1: It shows the first page design that will pop up when the application starts.

The figures above show the first page design that will pop up for a few seconds before it goes to the login page where it will be called as the startup pages of the app. The page will include the logo of the app.

II. Login Page

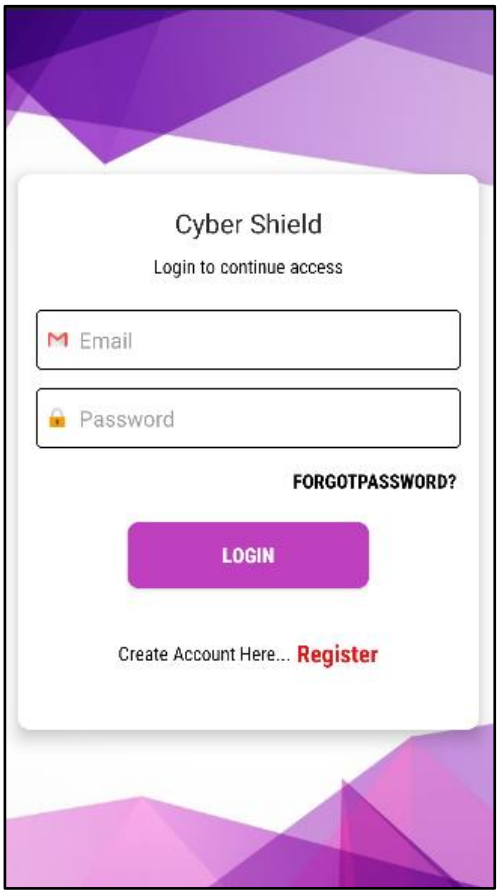


Figure 4.3.1.2: Login Page of CyberShield ✓

The figures above illustrate the application's login page design, where users need to login to the system by filling up the username and respective password.

III. Register Page

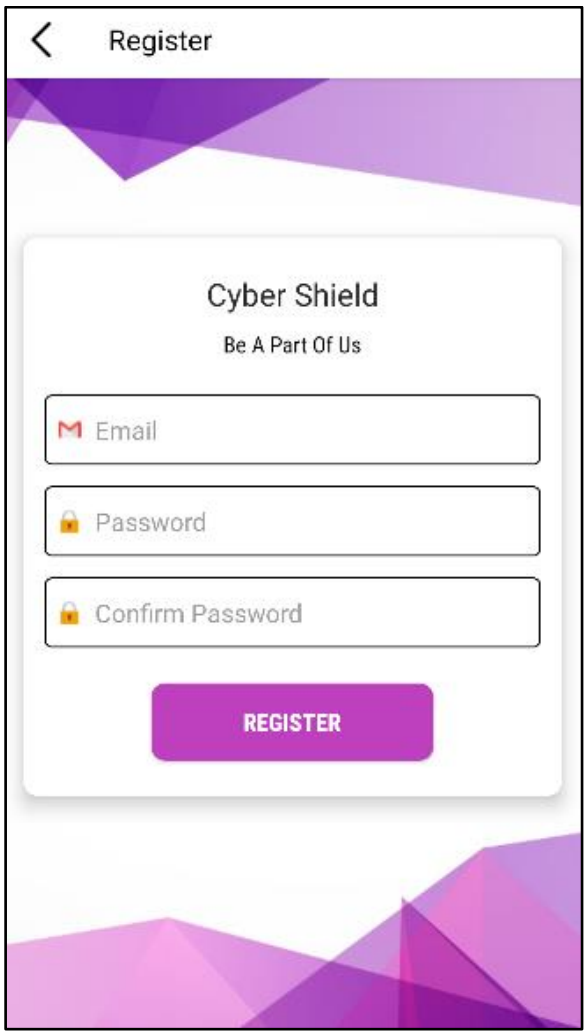


Figure 4.3.1.3: Register Page of CyberShield

This is the registration page. If a user does not have an account, they must create one using a valid email address, password, and confirmation of the password. They then need to click on the "Register" button to complete the process. Note that only users need to sign up on this page, admin accounts are added by an existing admin within the app itself.

IV. Forget Password Page

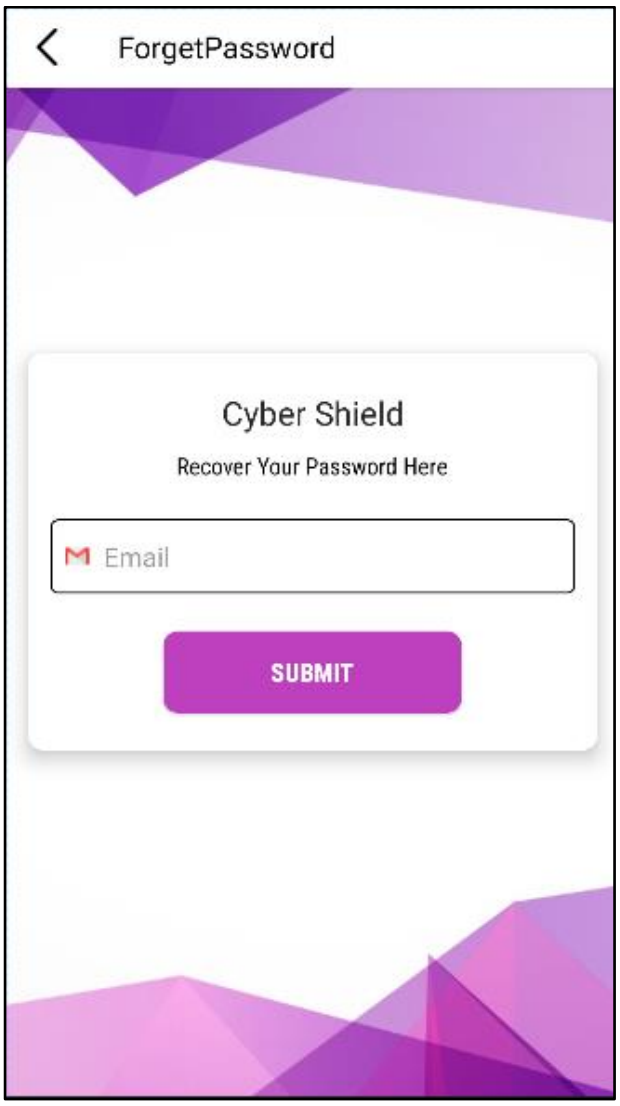


Figure 4.3.1.4: Forget Password Page of CyberShield

This is the "Forgot Password" page. If a user forgets their password, they can reset it by entering a valid email address and clicking the "Submit" button. The user will receive an email with a link to create a new password. By clicking on the provided link, they can set a new password.

V. Home Page

Figure 4.3.1.5: Homepage Of CyberShield

The figure above illustrates the design of the home page. Users can navigate through the application by selecting from five different features which are Scenario, Quizzes, Storyline, User Feedback, and Profile.

VI. Scenario Page

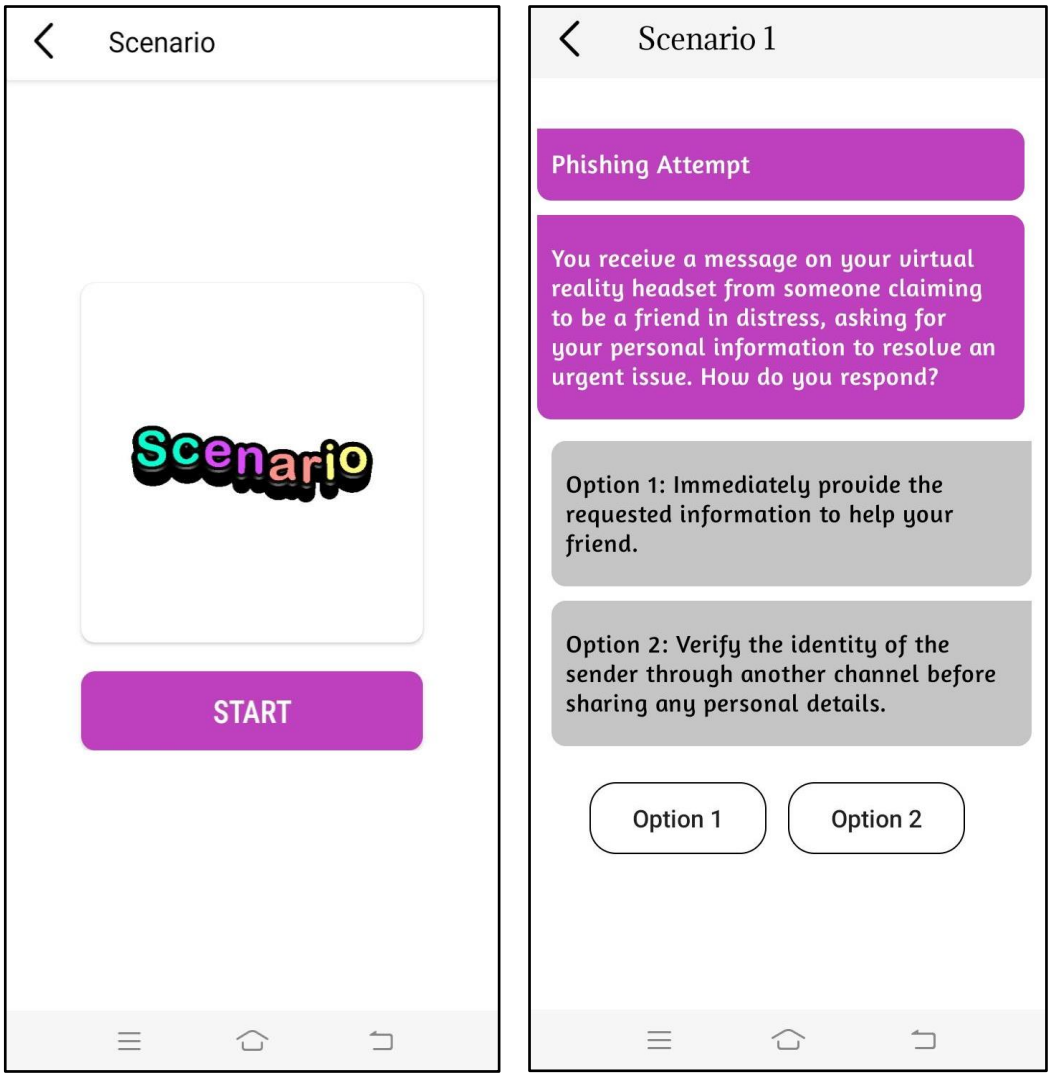


Figure 4.3.1.6: Scenario page of CyberShield

The figure above illustrates the scenario page design. Users begin by clicking on the "Start" button, which navigates them to a new page displaying various scenarios. Users can select one of the options presented below each scenario. The system subsequently reveals the correct answer.

VII. Quiz Page

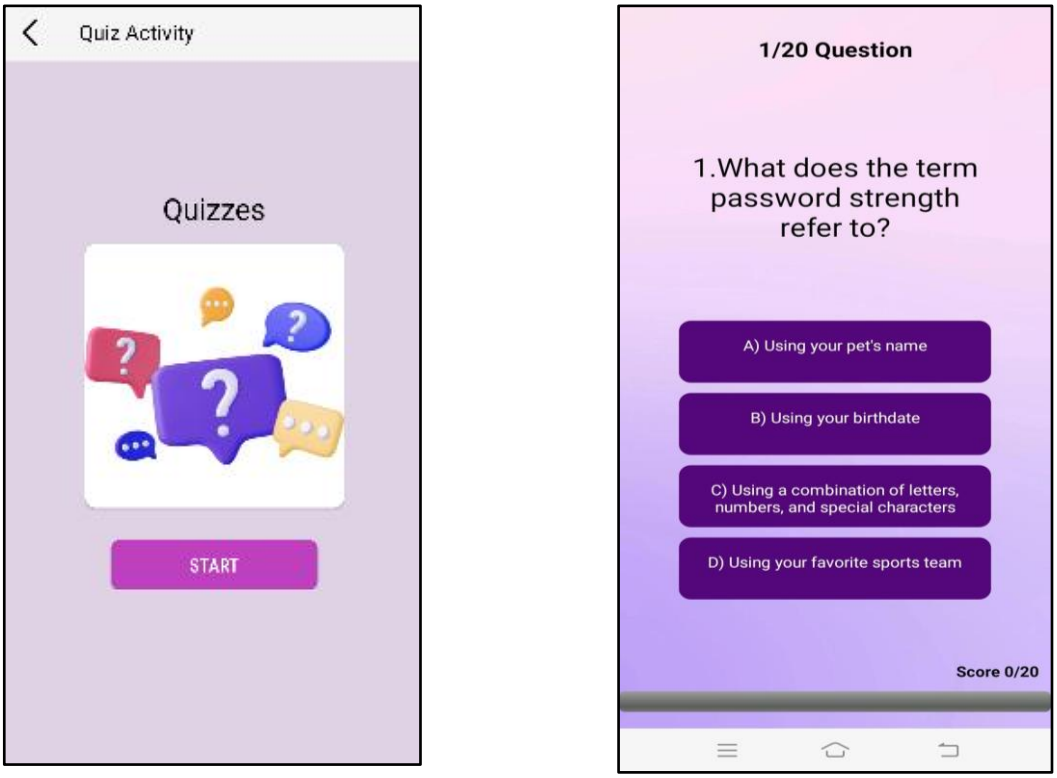


Figure 4.3.1.7: Quiz Activity of CyberShield

The figure above illustrates the Quiz page design of the application, accessible from the home page by selecting the Quiz option. On this new page, users can click the Start button to begin their quizzes and test their knowledge of cybersecurity. This page enables users to attempt quizzes, thereby enhancing their understanding of cybersecurity concepts.

VIII. Storyline Page

Figure 4.3.1.8: Storyline page of CyberShield

The figure above illustrates the Storyline page design of the application, accessible from the home page by selecting the Storyline option. On this page, users are guided through various cybersecurity challenges via an engaging narrative.

IX. Feedback Page

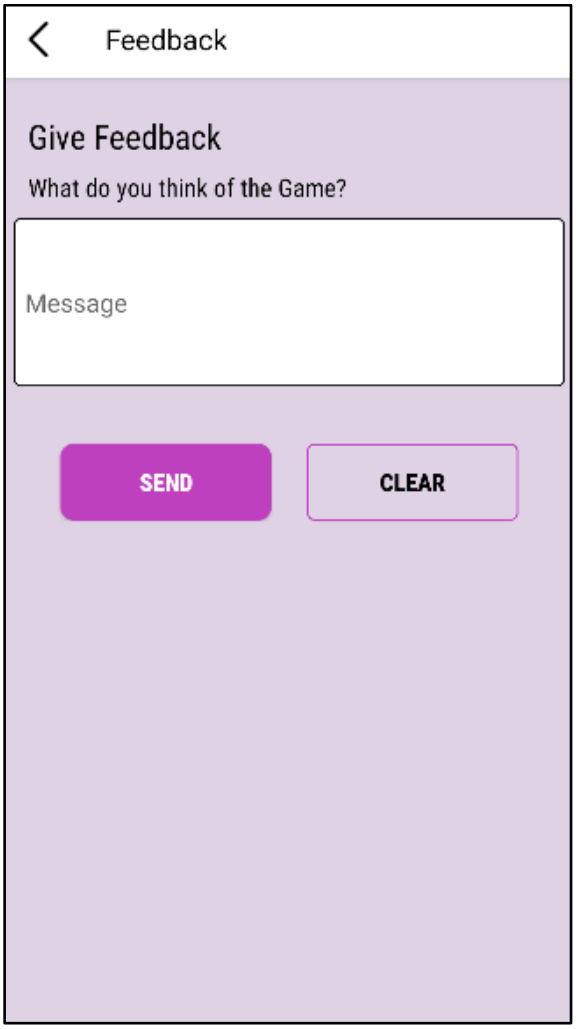


Figure 4.3.1.9: Feedback Form of CyberShield

This is the feedback form page. The users may provide the feedback to improve the application.

X. Profile Page

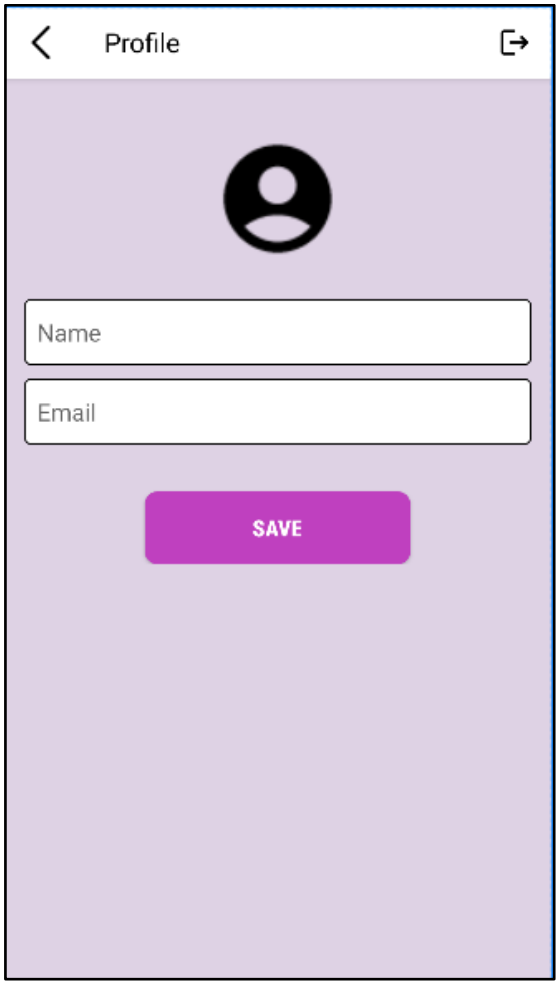


Figure 4.3.1.10: Profile of CyberShield

The figure above displays the Profile page design, which users can access by clicking the Profile icon at the top right of the Home page. On this page, users can change their name, and email address, upload a picture, and sign out of their account.

4.4 Database Design and Implementation

For the "CyberShield" educational game application, Firebase was selected as the backend database for its robust, scalable, and real-time data synchronization capabilities, which are crucial for delivering a seamless user experience. Firebase's suite of integrated tools, including authentication, cloud storage, and real-time database functionalities, caters to the diverse needs of our game development process. Firebase Authentication manages user sign-ups and logins, ensuring secure access, while each user's unique profile stored in Firebase Fire store contains details such as username, email, and password, enabling a personalized gaming experience and tracking individual progress.

Fire store records each player's progress through various game levels and challenges, including decisions, quiz scores, scenario completions, and time spent on activities. This detailed data collection allows for the analysis of user engagement and the effectiveness of the game in teaching cybersecurity concepts. Additionally, all educational content, such as quiz questions, interactive scenarios, and storyline elements, is stored in Firebase, allowing for dynamic updates without requiring new downloads. Firebase's real-time capabilities ensure that new content and updates are instantly available to all users, maintaining the game's relevance and engagement.

During user testing phases, player feedback is collected through in-game surveys and focus group discussions, stored in Firebase for real-time analysis. This centralized feedback collection facilitates quick iterations and improvements to the game based on user input. Firebase's built-in security features, including data encryption, user authentication, and secure cloud storage, protect user data from unauthorized access and ensure compliance with data protection regulations. The implementation involved setting up a Firebase project, defining data models for user profiles, game progress, educational content, and feedback, integrating Firebase SDK into the game application, enabling real-time data updates, and configuring Fire store security rules to control data access. This comprehensive approach establishes a flexible, secure, and efficient database solution that supports the dynamic and interactive nature of the "CyberShield" game, enhancing

performance and ensuring the effective monitoring and improvement of cybersecurity awareness among players.

4.5 Testing Phase

The testing phase is a crucial component of the project, offering an opportunity to assess the effectiveness, usability, and impact of the "CyberShield" game in real-world educational environments. This section outlines the methodology, procedures, and results of the testing phase, highlighting key findings and insights obtained through thorough analysis.

The testing phase was conducted in collaboration with a counseling teacher from SMK(F) Palong 2 and involved a sample of 50 students who had participated in the pilot study's data collection. Both formative and summative testing methods were used. Formative testing involved user testing sessions to gather feedback on the "CyberShield" game's usability, functionality, and overall user experience. These sessions allowed the teacher and students to interact with the game, providing feedback on engagement levels, navigation patterns, and learning outcomes. Concurrently, observational studies were conducted to evaluate user interactions with the game's features, enhancing the understanding of user engagement and behavior. Post-testing questionnaires were administered to collect quantitative data on students' levels of satisfaction, perceived benefits, and suggestions for improvement.

The feedback collected through the questionnaires provided critical information about the "CyberShield" game's usability, accessibility, and educational value. For instance, student engagement in cybersecurity education increased significantly due to the immersive and interactive nature of the game. Evaluations revealed that students who used the "CyberShield" game demonstrated better comprehension and retention of cybersecurity concepts. Additionally, students overwhelmingly appreciated the game's usability and functionality, offering valuable suggestions for enhancements, such as adding more interactive features and expanding content.

Moving forward, the findings from the testing phase highlight the potential of the "CyberShield" game to revolutionize cybersecurity education by promoting greater engagement and understanding among students. Future recommendations include improving the interface design, increasing content availability, and enhancing the integration of the "CyberShield" game into the classroom curriculum.

In conclusion, the testing phase is a pivotal step in the development and refinement of the "CyberShield" game, providing essential insights into its effectiveness and usability in educational settings. This phase lays the groundwork for future upgrades and enhancements, ensuring that the "CyberShield" game remains a powerful tool for cybersecurity education by leveraging student feedback.

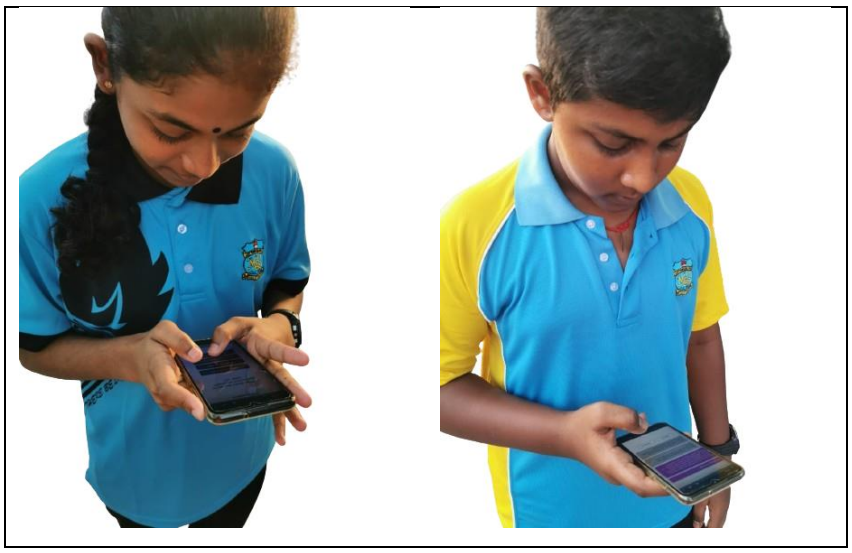


Figure 4.5: Student Experience and Interaction

4.6 Discussion and Findings of Testing

After the development of the CyberShield game application, a survey was conducted to gather feedback from 50 students who had previously participated in the data collection for the pilot study of participants. This survey aimed to evaluate the application's usability, effectiveness in teaching cybersecurity concepts, and overall user experience. The insights gained from this survey are crucial in understanding the strengths and areas for improvement in the application, ensuring it meets the educational goals and provides an engaging learning experience for users. The following sections present the key findings and analysis of the survey results.

Section A: Demographic Question

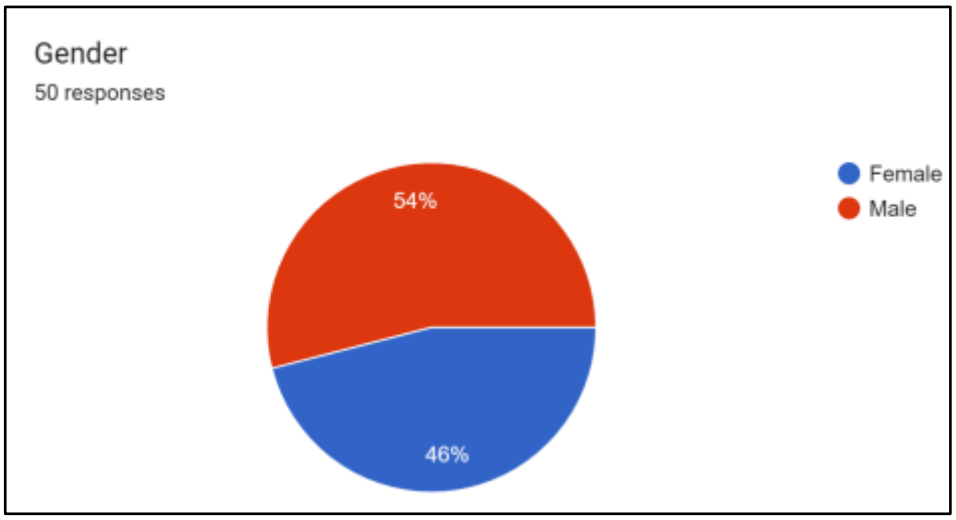


Figure 4.6.1: Gender Distribution Among Survey Respondents

The pie chart above shows the results of a survey on gender distribution among 50 participants. The chart reveals that the gender representation is balanced, with females comprising 54% and males accounting for 46%. However, due to the limitations of the pie chart, we cannot determine the exact number of respondents from each gender.

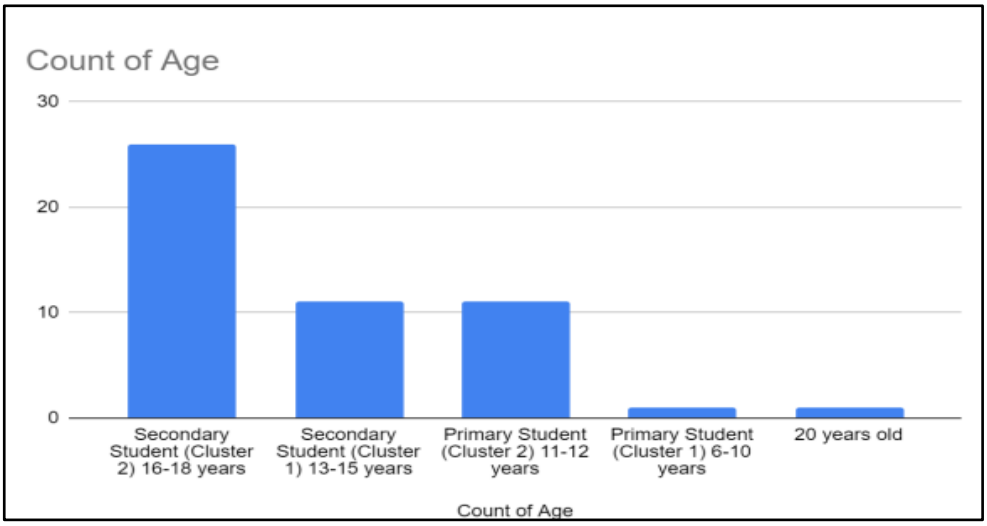


Figure 4.6.2: Distribution of students by age clusters

The bar chart above illustrates the age distribution of students participating in the pilot study. The information is categorized into four clusters, each representing a specific age range. Cluster 2, encompassing students aged 16-18, has the highest student count, with approximately 28 students. Cluster 1, which combines students aged 11-12 years and 13-15 years, has around 10 and 12 students respectively. Cluster 4, with students aged 20 years old, and Cluster 1 with students aged 6-10 years, have the fewest students, at around 5 each.

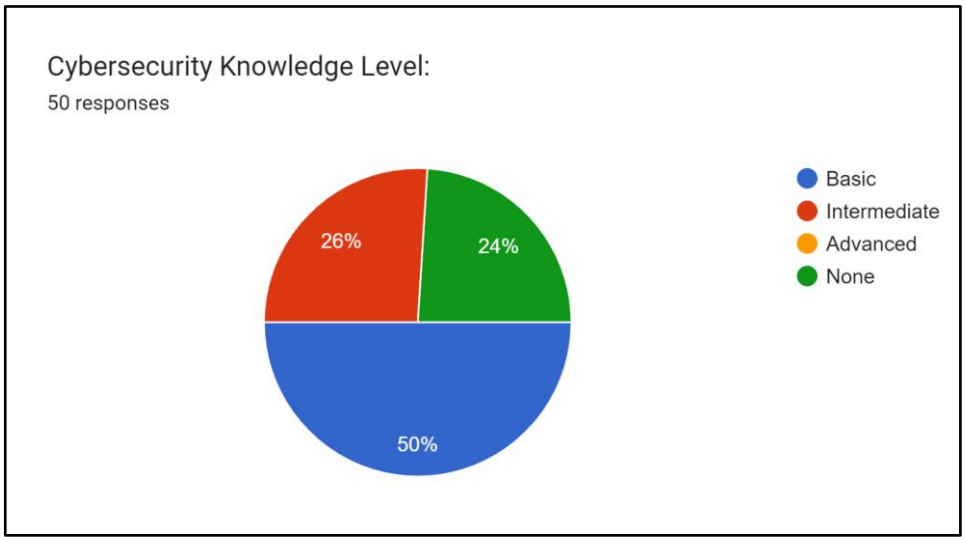


Figure 4.6.3: Distribution of Survey Respondents on Cybersecurity Knowledge Level

This pie chart shows the results of a survey on cybersecurity knowledge levels. According to the survey, only 50% of respondents have a basic level of cybersecurity knowledge. A slightly larger percentage, 26%, have an intermediate level of knowledge. The most concerning finding from the survey is, 24%, of the respondents have no cybersecurity knowledge.

Section B: Engagement and Learning

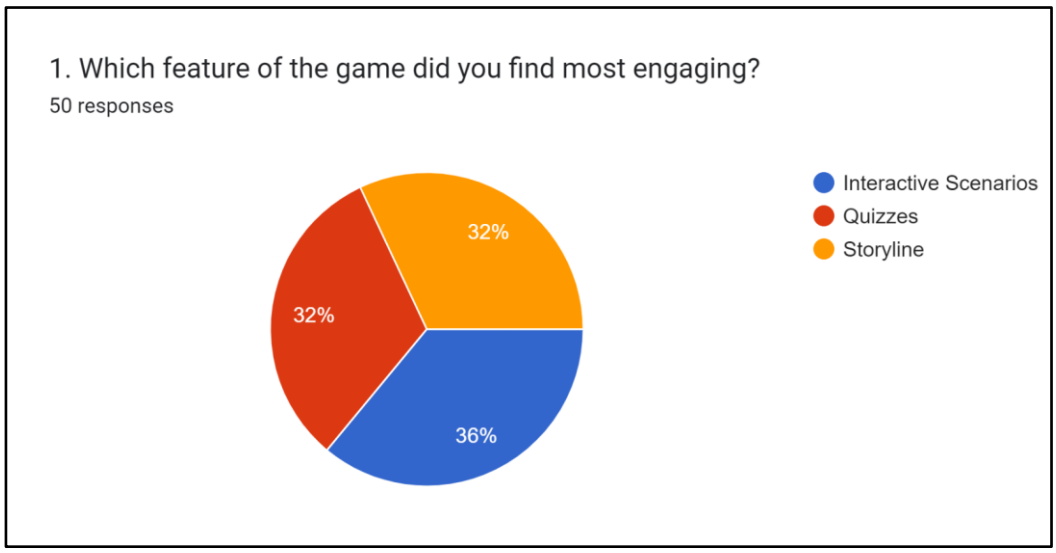


Figure 4.6.4: Distribution of Survey Respondents on Most Engaging Feature in a Game

This pie chart shows the results of a survey on the most engaging feature in a game. Of the 50 people surveyed, 36% found interactive scenarios to be the most engaging feature. Storyline and quizzes were tied for second place, with 32% of people finding each to be the most engaging feature. It's interesting to note that interactive scenarios, which may allow for more player agency and control over the narrative, were the most popular choice.

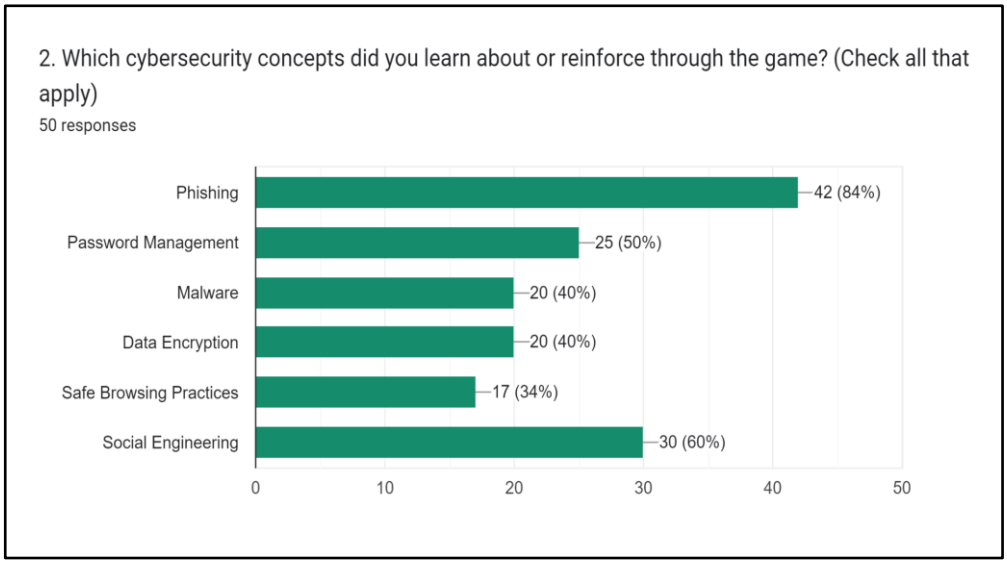


Figure 4.6.5: Distribution of Survey Respondents on Cybersecurity Concepts Learned Through Gameplay

This bar graph shows the results of a survey on which cybersecurity concepts people learned about or reinforced through a game. Phishing was the most common concept learned or reinforced, with 84% of respondents indicating this. Social engineering was the second most common concept, with 60% of respondents indicating they learned about or reinforced this concept through the game. Less than half of the respondents indicated that they learned about or reinforced password management (50%), data encryption (40%), malware (40%), and safe browsing practices (34%) through the game. Overall, the graph suggests that the game was effective at teaching people about phishing and social engineering.

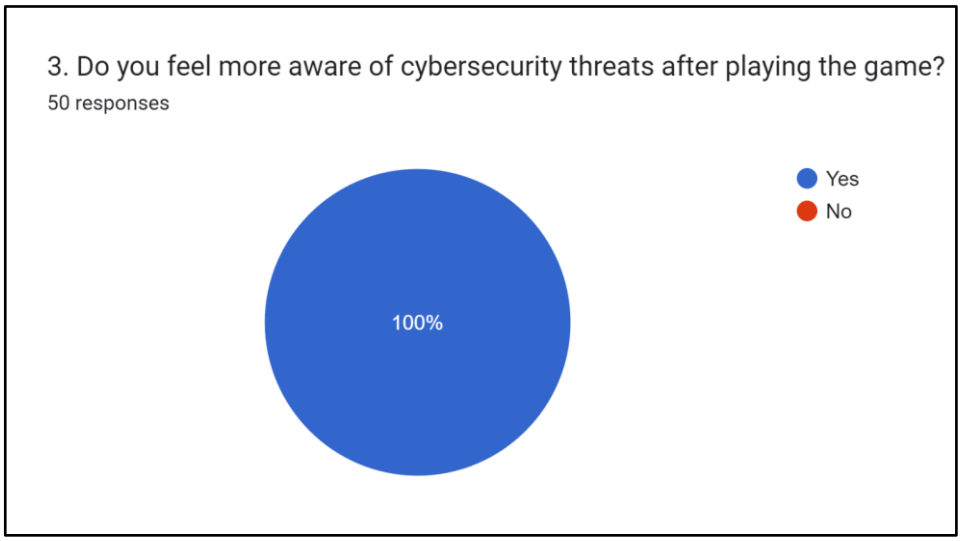


Figure 4.6.6: Distribution of Survey Respondents on Increased Cybersecurity Awareness After Playing a Game

This pie chart shows the results of a survey question asking if people felt more aware of cybersecurity threats after playing a game. All 50 respondents (100%) said yes, they felt more aware of cybersecurity threats after playing the game. This suggests that the game was effective in raising cybersecurity awareness among the people who played it. Cybersecurity awareness training can help people to protect themselves from online threats, so it's positive that the game appears to have been successful.

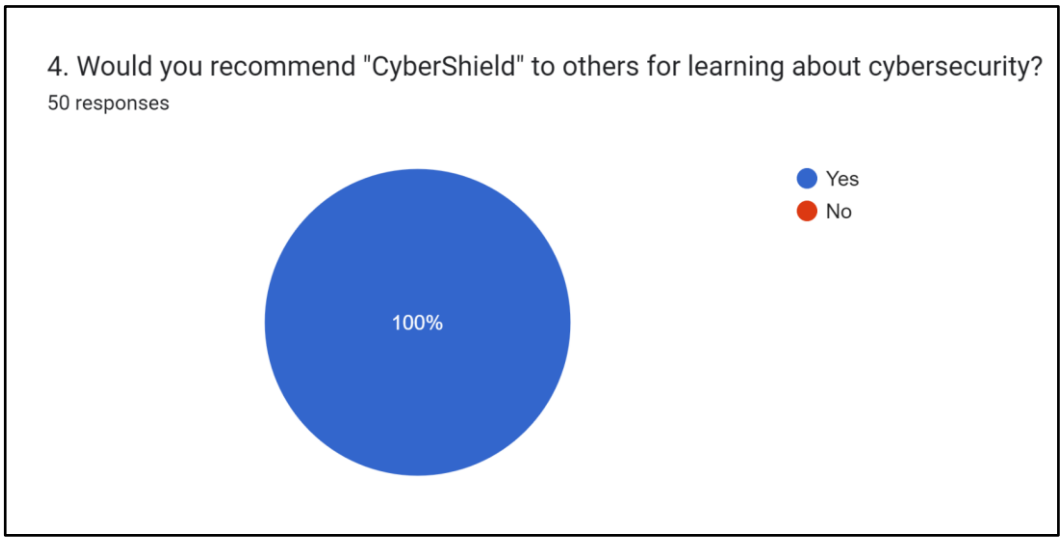


Figure 4.6.7: Reviews for CyberShield as a Cybersecurity Learning Tool

This pie chart shows the results of a survey question asking if people would recommend CyberShield to others for learning about cybersecurity. All 50 respondents (100%) said yes, they would recommend CyberShield. This suggests that people found CyberShield to be a valuable tool for learning about cybersecurity. It's positive that people found CyberShield to be a helpful resource.

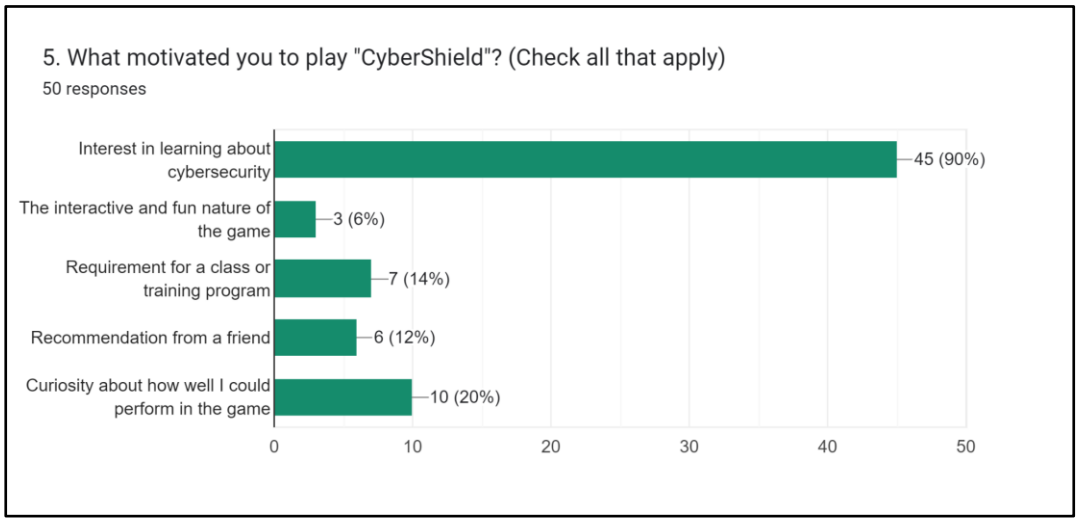


Figure 4.6.8: Distribution of Survey Respondents on Motivations for Playing CyberShield

This bar graph shows the results of a survey on why people decided to play CyberShield. The most common reason was to learn about cybersecurity, with 90% of respondents indicating this as a motivation. Some other motivations were less common. 6% of respondents said they were motivated by the interactive and fun nature of the game. 14% said they played CyberShield because it was a requirement for a class or training program. A smaller percentage, 12%, said they were motivated by a recommendation from a friend. Finally, 20% of respondents indicated that they were curious about how well they could perform in the game. Overall, the survey results show that the primary motivation for playing CyberShield was to learn about cybersecurity. This suggests that the game was successful in attracting its target audience.

Section C: Cybersecurity Awareness and Behavior

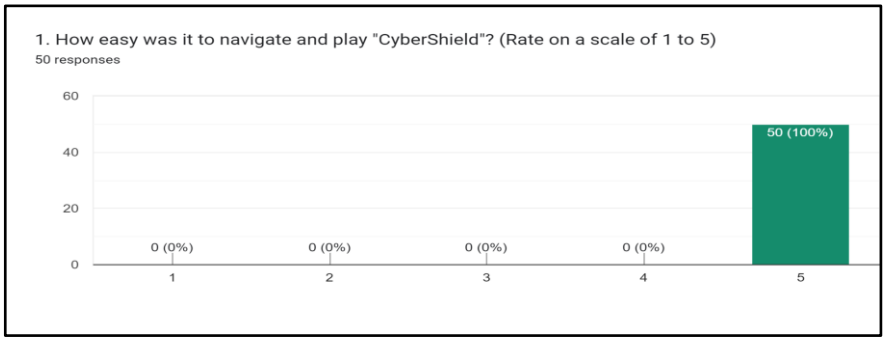


Figure 4.6.9: Distribution of Survey Respondents on Use for Navigating and Playing CyberShield

The line graph shows how easy people found it to navigate and play CyberShield. The scale ranges from 1 (most difficult) to 5 (easiest). The majority of respondents, 100%, found CyberShield to be very easy to navigate and play (rating of 5). Overall, the line graph suggests that most people found CyberShield to be easy to navigate and play.

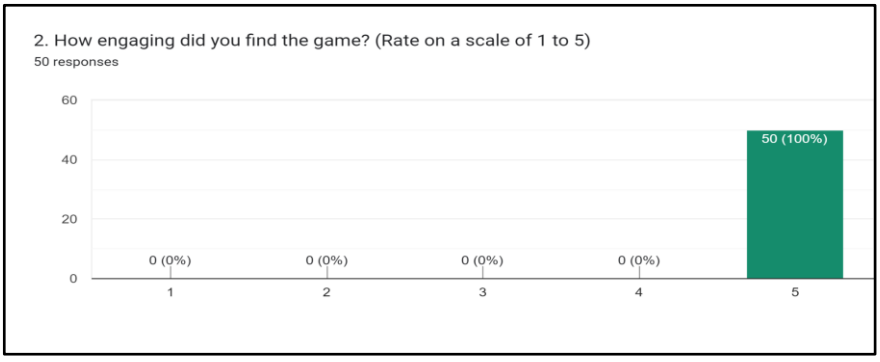


Figure 4.6.10: Distribution of Survey Respondents on Player Engagement in Game

The line graph displays the results of a user survey question asking how engaging users found the game. All 50 respondents (100%) rated the game as the most engaging option (5 on the scale of 1 to 5). This suggests that the game was very well received by the users who played it. There are many reasons why a game might be considered engaging, such as an interesting story, challenging gameplay, or rewarding mechanics.

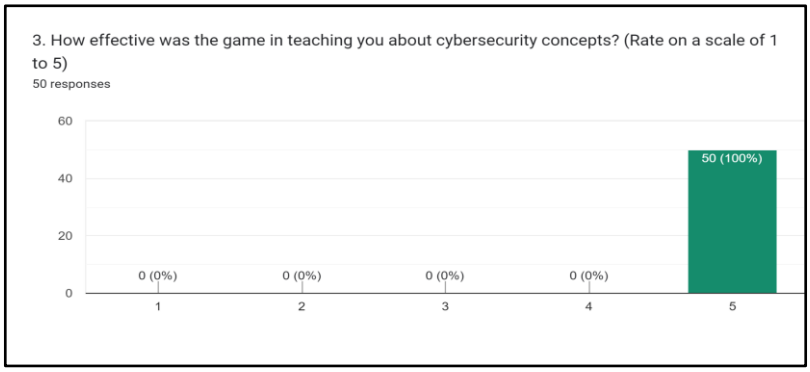


Figure 4.6.11: Distribution of Survey Respondents on Effectiveness of CyberShield in Teaching Cybersecurity Concepts

The bar graph shows the results of a survey on how effective CyberShield was in teaching users cybersecurity concepts. All 50 respondents (100%) rated the game as the most effective option (5 on the scale of 1 to 5). This suggests that the users who played CyberShield found it to be very effective in teaching them cybersecurity concepts. There are many ways that games can be educational, such as by providing interactive scenarios where users can apply their knowledge.

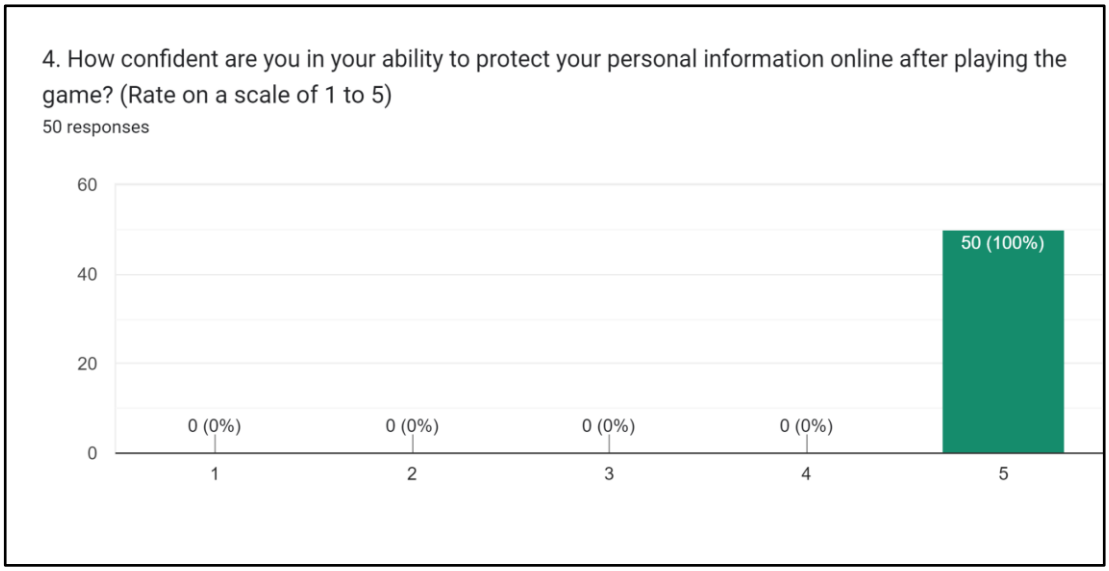


Figure 4.6.12: Distribution of Survey Respondents on Confidence in Protecting Personal Information Online After Playing CyberShield

The bar graph shows the results of a survey question asking how confident users felt in their ability to protect their personal information online after playing CyberShield. All 50 respondents (100%) indicated the highest level of confidence (5 on the scale of 1 to 5). This suggests that CyberShield was very effective in boosting users' confidence in their ability to protect their personal information online. There are many ways that cybersecurity awareness training can help people protect themselves online, such as teaching them how to identify phishing attempts and create strong passwords. It's positive that CyberShield appears to have been successful in this area.

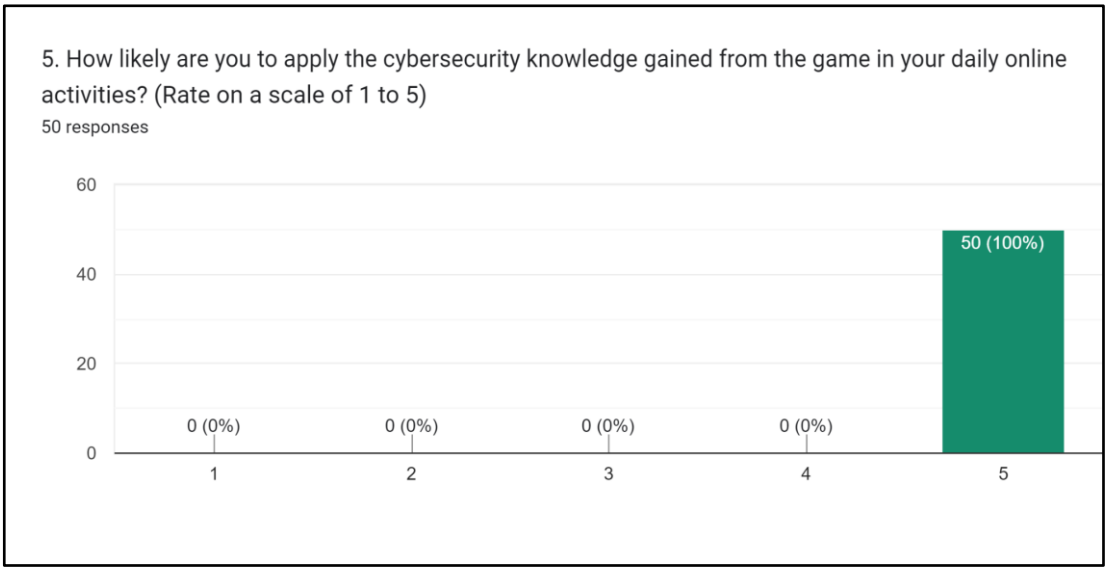


Figure 4.6.13: Distribution of Survey Respondents on Likelihood of Applying Cybersecurity Knowledge from Game

The bar graph shows the results of a survey question asking how likely respondents were to apply the cybersecurity knowledge they gained from the game in their daily online activities. All 50 respondents (100%) said they were very likely to apply this knowledge (5 on a scale of 1 to 5). This suggests that the game was very effective in motivating users to apply the cybersecurity knowledge they learned while playing. There are many reasons why people might not apply knowledge they learn, even if they find it interesting. For example, people may forget the information, or they may not see how it applies to their own lives. The fact that 100% of respondents indicated they would apply their knowledge suggests that the game may have been successful in overcoming these challenges.

4.7 Conclusion

This chapter explores the innovative approach to enhancing cybersecurity education through the "CyberShield" game application. The research adopts a mixed-methods approach, utilizing both qualitative and quantitative methodologies. The qualitative aspect involves in-depth interviews with cybersecurity experts to understand the challenges and benefits of integrating gaming into education, while the quantitative aspect uses student questionnaires to assess their preferences and expectations for the "CyberShield" game.

The pilot study, conducted at SMK(F) Palong 2 and SK(F) Palong 2, involved 50 participants and provided crucial insights into students' existing knowledge, preferences for interactive learning, and anticipated impacts of the game. Data from the study highlighted gender distribution, age clusters, mobile phone usage, and recreational preferences among participants. It also revealed students' gaming habits, emphasizing the importance of user-friendly interfaces, clear instructions, and replay value in educational games.

The system interface for "CyberShield" was meticulously designed based on these insights, featuring intuitive navigation, engaging visuals, and interactive scenarios. The testing phase involved real-world deployment and user feedback, confirming the game's effectiveness in increasing cybersecurity awareness and comprehension among students. The game's usability, educational value, and engagement were highly rated by users, who appreciated its interactive and immersive approach.

Overall, the findings suggest that "CyberShield" significantly enhances cybersecurity education by making learning engaging and practical. The study underscores the potential of gamification in education and provides a foundation for further development and integration of such tools in the curriculum to bolster cyber resilience.

CHAPTER 5

SUMMARY

5.1 Summary of the Research

In summary, this research presents an innovative approach to cybersecurity education through the development and assessment of the "CyberShield" game application. By combining qualitative and quantitative methodologies, the study aims to enhance comprehension, engagement, and adherence to cybersecurity protocols among students. The pilot study conducted at SMK(F) Palong 2 and SK (F) Palong 2 involved interviews with a school counselor and surveys with 50 students to gather insights into their experiences, preferences, and challenges in cybersecurity education.

The findings from the pilot study reveal several key insights. Firstly, the gender distribution among participants was relatively balanced, with females comprising 54% and males 46%. Secondly, the age distribution showed a concentration of students aged 16-18, indicating a focus on older students. Thirdly, popular mobile phone brands among respondents included Samsung, Apple, and Oppo, with varying usage patterns.

Regarding recreational activities, playing video games emerged as the most popular pastime, followed by sports and outdoor activities, and watching movies and TV shows. When it comes to mobile gaming habits, a significant portion of respondents reported spending more than 6 hours daily on gaming. In terms of game design and graphics, the "CyberShield" game application received positive feedback. Participants rated the overall game design, graphics engagement, navigation, visual appeal of characters and objects, color scheme satisfaction, creativity, educational elements, thematic relevance, level of challenge, and feedback and rewards positively.

Additionally, insights into game preferences were gathered. Puzzle games emerged as the favorite genre, with in-game purchases like levels/expansions being deemed acceptable. Respondents preferred receiving updates monthly and showed a preference for games with open-world exploration, stylized/cartoonish graphics, and multiplayer gameplay. The research highlights the potential of gamified learning tools like "CyberShield" in enhancing cybersecurity education. By leveraging user feedback and iterative refinement, the study aims to empower users with essential knowledge and skills for navigating the digital landscape securely. The findings offer valuable insights for future research and innovation in educational technology, aiming to create engaging learning environments that foster active student participation and understanding.

5.1.1 Challenges of the Project

One significant challenge revolved around ensuring diverse representation and engagement among the target demographic. While the pilot study revealed a balanced gender distribution among participants, age clusters varied, posing a challenge in tailoring the game's content to suit different age groups effectively. To address this, the development team implemented adaptive content delivery mechanisms within the game, allowing for personalized experiences based on the player's age and proficiency level. By dynamically adjusting challenges and educational content, the game could cater to a broader audience while maintaining engagement across various age groups.

Another challenge emerged regarding mobile phone usage habits among the participants, highlighting the need to optimize the game for different devices and screen sizes. To tackle this, the development team employed responsive design principles to ensure the game's compatibility with a wide range of mobile devices. By prioritizing scalability and optimization, they ensured a seamless gaming experience regardless of the device used, thereby maximizing accessibility and user satisfaction.

Additionally, feedback from the pilot study underscored the importance of balancing educational content with entertainment value to sustain player engagement over time. To address this challenge, the team iteratively refined the game's narrative, incorporating gamification techniques to incentivize learning while maintaining an immersive and enjoyable gameplay experience. By integrating feedback loops, rewards, and interactive storytelling elements, they enhanced the educational efficacy of the game while fostering long-term player engagement and retention.

Furthermore, ensuring sustainability and scalability posed a challenge, particularly concerning the game's deployment across diverse educational settings. To mitigate this challenge, the development team adopted cloud-based infrastructure and agile development methodologies to facilitate seamless updates, scalability, and maintenance. By leveraging cloud technologies, they could deploy updates and patches efficiently, ensuring continuous improvement and adaptation to evolving cybersecurity threats and educational needs.

In conclusion, addressing these challenges required a multidisciplinary approach, combining technical expertise with pedagogical insights and user feedback. By embracing adaptability, innovation, and user-centric design principles, the "CyberShield" game application emerged as a robust and effective tool for cybersecurity education, poised to empower users worldwide with essential knowledge and skills for navigating the digital landscape securely.

5.2 Contributions of the Project

The project "CyberShield" makes significant contributions to the realm of cybersecurity education through its innovative approach, encapsulated within an immersive gaming experience. By meticulously blending qualitative insights and quantitative data, the endeavor not only addresses prevailing challenges in cybersecurity education but also pioneers a novel pathway towards heightened awareness and adeptness in cybersecurity practices.

Firstly, the project facilitates a nuanced understanding of user perspectives and preferences by engaging in comprehensive qualitative interviews with cybersecurity specialists and educational stakeholders. These insights serve as foundational pillars, guiding the design and development phases of the "CyberShield" game application with precision and agility. By incorporating expert opinions and student feedback, the project ensures that the resultant educational tool is tailored to effectively address identified cybersecurity challenges.

Moreover, through the deployment of quantitative methodologies such as student questionnaires, the project gathers extensive data to gauge attitudes, preferences, and expectations regarding cybersecurity education and the gamified learning tool. The findings from these surveys offer invaluable insights into participant engagement, learning methodologies, and perceptions of the "CyberShield" game application, thereby informing iterative refinement and optimization for enhanced educational outcomes.

The pilot study conducted at SMK(F) Palong 2 and SK (F) Palong 2 serves as a testament to the project's efficacy in fostering cybersecurity awareness and behavior among students. By soliciting feedback from both students and educators, the study not only identifies areas of strength within the game application but also pinpoints avenues for improvement, ensuring its relevance and effectiveness within educational settings.

Furthermore, the project's emphasis on real-world deployment and collaborative engagement with users and cybersecurity professionals underscores its commitment to rigorous evaluation and continuous improvement. By evaluating the impact, usability, and efficacy of the game application in diverse educational settings, the project not only validates its effectiveness but also fosters a culture of cyber resilience on a global scale.

In essence, the contributions of the "CyberShield" project transcend mere technological innovation, extending into the realms of education, awareness, and empowerment. By harnessing the power of gamification principles, qualitative insights, and quantitative data, the project not only equips users with essential cybersecurity knowledge and skills but also cultivates a proactive approach towards safeguarding digital landscapes worldwide.

5.3 Future Works

1. Gameplay Mechanics and User Interface Optimization:
    - Future efforts could focus on refining and optimizing the gameplay mechanics and user interface. This may involve streamlining navigation, enhancing graphics and audio elements, and addressing any identified usability issues to ensure seamless interaction for players of all skill levels.

2. Expansion of Educational Content:
    - Expanding the scope and depth of educational content within the game could be a key area for development. Introducing new cybersecurity concepts, challenges, and scenarios would not only enrich the learning experience but also cater to diverse learner preferences and knowledge levels. Additionally, integrating real-world case studies and simulations could provide practical insights into cybersecurity practices and decision-making processes.

3. Integration of Emerging Technologies:
    - Leveraging emerging technologies such as artificial intelligence (AI) and machine learning (ML) could enhance the adaptive capabilities of the game. By analyzing player behavior and performance data, AI algorithms could dynamically adjust the difficulty level, content delivery, and feedback mechanisms to better suit individual learning styles and preferences.

4. Gamification and Engagement Enhancements:
    - In line with the principles of gamification, future iterations of the "CyberShield" game application could incorporate more interactive elements and rewards systems to foster greater engagement and motivation among players. This could involve introducing collaborative multiplayer modes, competitive leaderboards, and personalized achievement systems to incentivize continued participation and skill development.

5. Ongoing Research and Collaboration:
    - Ongoing research and collaboration with cybersecurity experts and educators will be essential to ensure the relevance and efficacy of the game in addressing evolving cybersecurity challenges and educational needs. By soliciting feedback, conducting user testing, and iteratively refining the game based on insights gathered from stakeholders, the "CyberShield" application can continue to serve as a valuable tool for cybersecurity education and awareness on a global scale.

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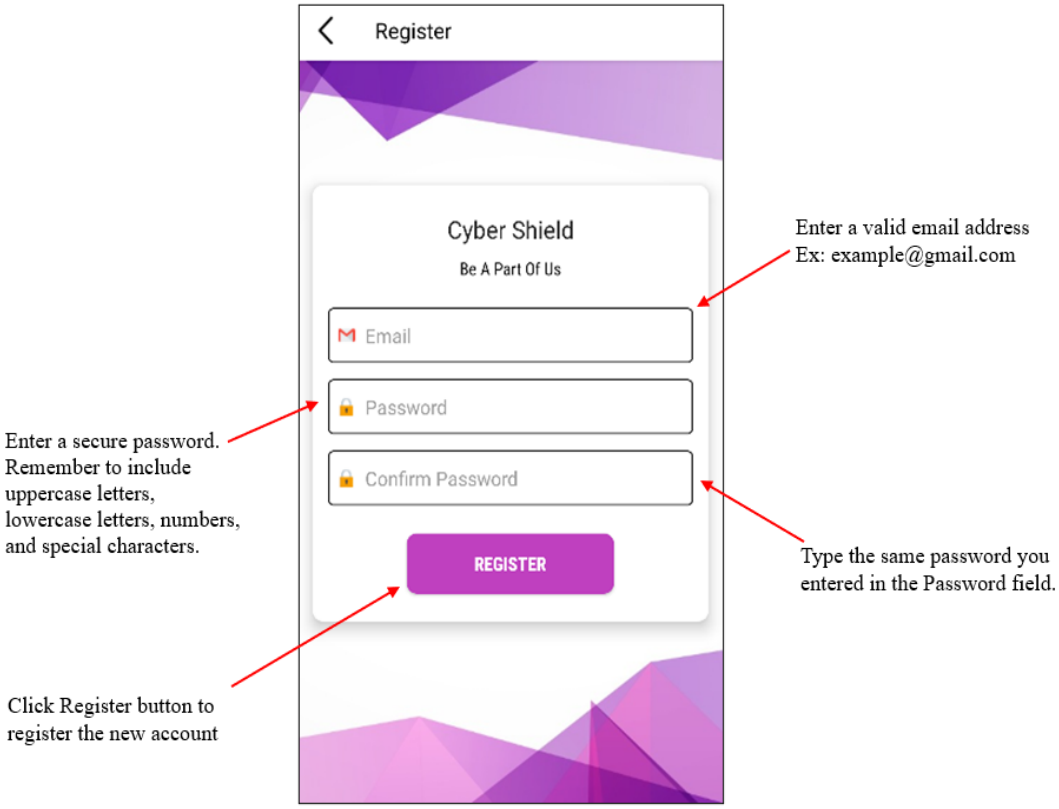
APPENDIX

A. User Manuals

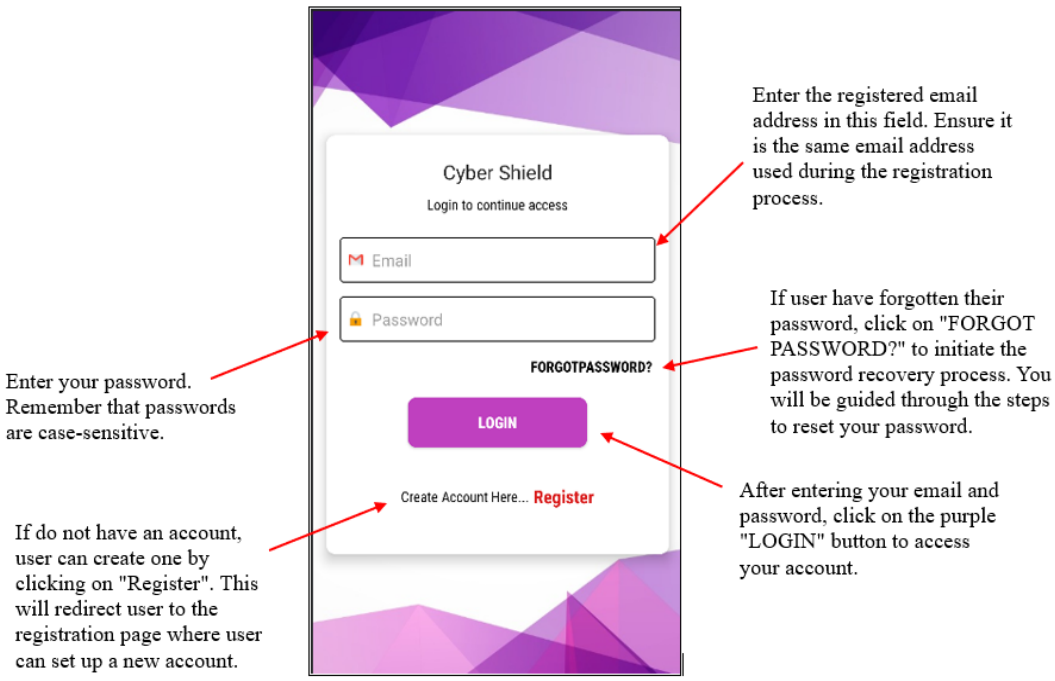
1. Registration

This user manual will guide users through the registration process for our platform. Follow the steps below to create your account and become a part of our community.



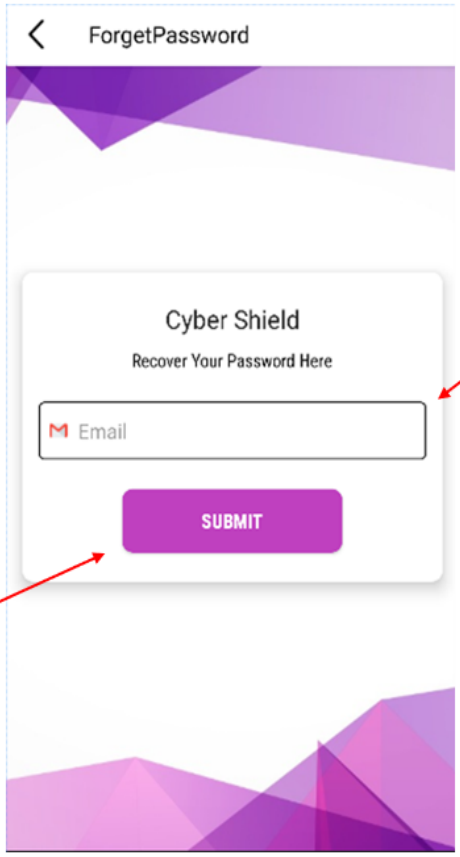
2. Login

This manual will guide users through the steps to access and utilize the login features of our application.



3. Forgot Password

This manual will guide users through the steps to recover the password if you have forgotten it.



Enter the registered email address in this field. This should be the email address associated with your Cyber Shield account.

After entering email address, click on the purple "SUBMIT" button to initiate the password recovery process. Users will receive an email with instructions on how to reset their password. Follow the instructions provided in the email to create a new password. Use the link provided in the email to access the password reset page. Enter a new password and confirm it to update user account credentials.

B. Code Listings

Coding of User Home Activity

```
package com.example.cybershieldv3;

import androidx.appcompat.app.AppCompatActivity;

import android.content.Intent;
import android.os.Bundle;
import android.os.health.UidHealthStats;
import android.view.View;
import android.widget.Button;
import android.widget.ImageView;

import com.airbnb.lottie.LottieAnimationView;

public class UserHomeActivity extends AppCompatActivity {

    Button Scenario,Quiz,feedBack,story;
    ImageView profile;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_user_home);

        Scenario = findViewById(R.id.btnScenario);
        Quiz = findViewById(R.id.btnQuizzes);
        feedBack = findViewById(R.id.btnUserFeedback);
        story = findViewById(R.id.btnStoryline);
        profile = findViewById(R.id.btnProfile);
```

```
        profile.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                startActivity(new Intent(UserHomeActivity.this,
UserProfileActivity.class));
            }
        });

        story.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                startActivity(new Intent(UserHomeActivity.this,
UserStoryLineActivity.class));
            }
        });

        feedBack.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                startActivity(new Intent(UserHomeActivity.this,
FeedbackActivity.class));
            }
        });

        Scenario.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                startActivity(new Intent(UserHomeActivity.this,
ScenarioActivity.class));
            }
        });
```

```
        Quiz.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                startActivity(new Intent(UserHomeActivity.this,
QuizHomeActivity.class));
            }
        });


    }
}
```

Coding of Quiz Activity

```
package com.example.cybershieldv3;

import androidx.appcompat.app.AlertDialog;
import androidx.appcompat.app.AppCompatActivity;

import android.annotation.SuppressLint;
import android.content.DialogInterface;
import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.widget.ProgressBar;
import android.widget.TextView;
import android.widget.Toast;

public class QuizStartActivity extends AppCompatActivity {

    private TextView optionA,optionB,optionC,optionD;
    private TextView questionnumber,question,score;
    private TextView chechkout1,checkout2;
    int currentIndex;
```

```
    int mscore=0;
    int qn=1;
    ProgressBar progressBar;
    int
CurrentQuestion,CurrentOptionA,CurrentOptionB,CurrentOptionC,CurrentO
ptionD;


    private answerclass[] questionBank= new answerclass[] {


            new
answerclass(R.string.question_1,R.string.question1_A,R.string.question1_B,
R.string.question1_C,R.string.question1_D,R.string.answer_1),
            new
answerclass(R.string.question_2,R.string.question2_A,R.string.question2_B,
R.string.question2_C,R.string.question2_D,R.string.answer_2),
            new
answerclass(R.string.question_3,R.string.question3_A,R.string.question3_B,
R.string.question3_C,R.string.question3_D,R.string.answer_3),
            new
answerclass(R.string.question_4,R.string.question4_A,R.string.question4_B,
R.string.question4_C,R.string.question4_D,R.string.answer_4),
            new
answerclass(R.string.question_5,R.string.question5_A,R.string.question5_B,
R.string.question5_C,R.string.question5_D,R.string.answer_5),
            new
answerclass(R.string.question_6,R.string.question6_A,R.string.question6_B,
R.string.question6_C,R.string.question6_D,R.string.answer_6),
            new
answerclass(R.string.question_7,R.string.question7_A,R.string.question7_B,
R.string.question7_C,R.string.question7_D,R.string.answer_7),
            new
answerclass(R.string.question_8,R.string.question8_A,R.string.question8_B,
R.string.question8_C,R.string.question8_D,R.string.answer_8),
            new
answerclass(R.string.question_9,R.string.question9_A,R.string.question9_B,
R.string.question9_C,R.string.question9_D,R.string.answer_9),
            new
answerclass(R.string.question_10,R.string.question10_A,R.string.question10
_B,R.string.question10_C,R.string.question10_D,R.string.answer_10),
```

```
        new
answerclass(R.string.question_11,R.string.question11_A,R.string.question11_
B,R.string.question11_C,R.string.question11_D,R.string.answer_11),

        new
answerclass(R.string.question_12,R.string.question12_A,R.string.question12
_B,R.string.question12_C,R.string.question12_D,R.string.answer_12),

        new
answerclass(R.string.question_13,R.string.question13_A,R.string.question13
_B,R.string.question13_C,R.string.question13_D,R.string.answer_13),

        new
answerclass(R.string.question_14,R.string.question14_A,R.string.question14
_B,R.string.question14_C,R.string.question14_D,R.string.answer_14),

        new
answerclass(R.string.question_15,R.string.question15_A,R.string.question15
_B,R.string.question15_C,R.string.question15_D,R.string.answer_15),

        new
answerclass(R.string.question_16,R.string.question16_A,R.string.question16
_B,R.string.question16_C,R.string.question16_D,R.string.answer_16),

        new
answerclass(R.string.question_17,R.string.question17_A,R.string.question17
_B,R.string.question17_C,R.string.question17_D,R.string.answer_17),

        new
answerclass(R.string.question_18,R.string.question18_A,R.string.question18
_B,R.string.question18_C,R.string.question18_D,R.string.answer_18),

        new
answerclass(R.string.question_19,R.string.question19_A,R.string.question19
_B,R.string.question19_C,R.string.question19_D,R.string.answer_19),

        new
answerclass(R.string.question_20,R.string.question20_A,R.string.question20
_B,R.string.question20_C,R.string.question20_D,R.string.answer_20),
    };


    final int PROGRESS_BAR = (int) Math.ceil(100/questionBank.length);


    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_quiz_start);
```

```
optionA=findViewById(R.id.optionA);
optionB=findViewById(R.id.optionB);
optionC=findViewById(R.id.optionC);
optionD=findViewById(R.id.optionD);

question = findViewById(R.id.question);
score=findViewById(R.id.score);
questionnumber=findViewById(R.id.QuestionNumber);

chechkout1=findViewById(R.id.selectoption);
checkout2=findViewById(R.id.CorrectAnswer);
progressBar=findViewById(R.id.progress_bar);

CurrentQuestion=questionBank[currentIndex].getQuestionid();
question.setText(CurrentQuestion);
CurrentOptionA=questionBank[currentIndex].getOptionA();
optionA.setText(CurrentOptionA);
CurrentOptionB=questionBank[currentIndex].getOptionB();
optionB.setText(CurrentOptionB);
CurrentOptionC=questionBank[currentIndex].getOptionC();
optionC.setText(CurrentOptionC);
CurrentOptionD=questionBank[currentIndex].getOptionD();
optionD.setText(CurrentOptionD);

optionA.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        checkAnswer(CurrentOptionA);
        updateQuestion();

    }
});
```

```
        optionB.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                checkAnswer(CurrentOptionB);
                updateQuestion();


            }
        });
        optionC.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                checkAnswer(CurrentOptionC);
                updateQuestion();


            }
        });
        optionD.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {

                checkAnswer(CurrentOptionD);
                updateQuestion();

            }
        });

    }

    private void checkAnswer(int userSelection) {
```

```
        int correctanswer=questionBank[currentIndex].getAnswerid();

        chechkout1.setText(userSelection);
        checkout2.setText(correctanswer);

        String m= chechkout1.getText().toString().trim();
        String n=checkout2.getText().toString().trim();

        if(m.equals(n))
        {
Toast.makeText(getApplicationContext(),"Right",Toast.LENGTH_SHORT).show();
            mscore=mscore+1;
        }
        else
        {
Toast.makeText(getApplicationContext(),"Wrong",Toast.LENGTH_SHORT).show();
        }



    }

    @SuppressLint("SetTextI18n")
    private void updateQuestion() {

        currentIndex=(currentIndex+1)%questionBank.length;
```

```
        if(currentIndex==0)
        {


            AlertDialog.Builder alert=new AlertDialog.Builder(this);
            alert.setTitle("Quiz Over");
            alert.setCancelable(false);
            alert.setMessage("Your Score" + mscore +"points");
            alert.setPositiveButton("Close Quiz", new
DialogInterface.OnClickListener() {
                @Override
                public void onClick(DialogInterface dialog, int which) {
                    Intent intent = new Intent(QuizStartActivity.this,
QuizHomeActivity.class);
                    startActivity(intent);
                }
            });


            alert.setNegativeButton("No", new DialogInterface.OnClickListener()
{
                @Override
                public void onClick(DialogInterface dialog, int which) {
                    mscore=0;
                    qn=1;
                    progressBar.setProgress(0);
                    score.setText("Score" + mscore +"/" +questionBank.length);
                    questionnumber.setText(qn + "/" + questionBank.length
+"Question");
                }
            });


            alert.show();


        }
```

```
        CurrentQuestion=questionBank[currentIndex].getQuestionid();
        question.setText(CurrentQuestion);
        CurrentOptionA=questionBank[currentIndex].getOptionA();
        optionA.setText(CurrentOptionA);
        CurrentOptionB=questionBank[currentIndex].getOptionB();
        optionB.setText(CurrentOptionB);
        CurrentOptionC=questionBank[currentIndex].getOptionC();
        optionC.setText(CurrentOptionC);
        CurrentOptionD=questionBank[currentIndex].getOptionD();
        optionD.setText(CurrentOptionD);

        qn=qn+1;

        if(qn<=questionBank.length)

        {
           questionnumber.setText(qn + "/" + questionBank.length +"Question");
        }
        score.setText("Score" + mscore +"/" +questionBank.length);
        progressBar.incrementProgressBy(PROGRESS_BAR);


    }

}
```

C. Additional Resources

https://youtu.be/pKMqJAc6wYw?si=fLJWPGvmDQsBokhE
https://youtu.be/ENK4ONrRm8s?si=6uqAQxETKhvB55-s