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Evaluating the impact of persona-driven game-based learning on children's understanding of personal boundaries

Avaliação do impacto da aprendizagem baseada em jogos orientados por personas na compreensão das crianças sobre limites pessoais

Evaluación del impacto del aprendizaje basado en juegos impulsado por personajes en la comprensión de los límites personales por parte de los niños

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Abstract

Understanding the concepts of personal safety is essential for the emotional and social development of children and has long-term implications for individuals and communities. Although safety education has been introduced into the Pakistani educational curriculum, traditional teaching methods often fail to meet diverse learning needs. This study investigates the effectiveness of persona-oriented game-based learning (GBL) in improving children's understanding of personal boundary concepts. A prototype game, Space Protectors, was developed using a persona-oriented framework based on four personality archetypes: Fighter, Collector, Social, and Curious. A chatbot using behavior trees assists players in selecting personas aligned with their interests, while allowing free persona switching and thus promoting autonomy and engagement. The game offers the same learning objectives through different play styles to reinforce retention and motivation. The study adopted a mixed-methods approach, using qualitative pre- and post-test research aligned with key learning indicators. A stealth assessment, based on Evidence-Centered Design (ECD), was integrated to evaluate the learning activities in the game. The results revealed significant improvements in concepts related to consent, maintenance, and boundary setting ($p < 0.001$), with medium to large effect sizes (Cohen's $d > 0.5$), demonstrating the game's effectiveness in enhancing learning about personal safety.

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Keywords
Game-Based Learning, Personal Space, Safety Education, AI Chatbots, Persona.

Resumo
Compreender os conceitos de segurança pessoal é essencial para o desenvolvimento emocional e social das crianças e tem implicações de longo prazo para indivíduos e comunidades. Embora a educação em segurança tenha sido introduzida no currículo educacional do Paquistão, os métodos tradicionais de ensino frequentemente não atendem às diversas necessidades de aprendizagem. Este estudo investiga a eficácia da aprendizagem baseada em jogos orientada por personas (GBL) na melhoria da compreensão das crianças sobre os conceitos de limites pessoais. Um protótipo de jogo, *Space Protectors*, foi desenvolvido utilizando uma estrutura orientada por personas baseada em quatro arquétipos de personalidade: Lutador, Colecionador, Social e Curioso. Um chatbot que utiliza árvores de comportamento auxilia os jogadores na seleção de personas alinhadas aos seus interesses, permitindo, ao mesmo tempo, a troca livre de personas e promovendo, assim, autonomia e engajamento. O jogo oferece os mesmos objetivos de aprendizagem, por meio de diferentes estilos de jogo, para reforçar a retenção e a motivação. O estudo adotou uma abordagem de métodos mistos, utilizando pesquisas qualitativas pré- e pós-teste, alinhadas aos indicadores-chave de aprendizagem. Uma avaliação discreta (*stealth assessment*), baseada no Design Centrado em Evidências (ECD), foi integrada para avaliar as atividades de aprendizagem no jogo. Os resultados revelaram melhorias significativas nos conceitos relacionados ao consentimento, à manutenção e à definição de limites ($p < 0,001$), com tamanhos de efeito médios a grandes (d de Cohen > 0,5), o que demonstra a eficácia do jogo em aprimorar a aprendizagem sobre segurança pessoal.
Palavras-chave
Aprendizagem Baseada em Jogos, Espaço Pessoal, Educação em Segurança, Chatbots de IA, Persona.

Resumen
Comprender los conceptos de seguridad personal es esencial para el desarrollo emocional y social de los niños y tiene implicaciones a largo plazo para las personas y las comunidades. Aunque la educación en seguridad se ha incorporado al currículo educativo de Pakistán, los métodos tradicionales de enseñanza a menudo no logran atender las diversas necesidades de aprendizaje. Este estudio investiga la eficacia del aprendizaje basado en juegos impulsado por personas (GBL) para mejorar la comprensión de los niños de los conceptos de límites personales. Se desarrolló un prototipo de juego, *Space Protectors*, utilizando un marco basado en personas sustentado en cuatro arquetipos de personalidad: Luchador, Coleccionista, Social y Curioso. Un chatbot que emplea árboles de comportamiento ayuda a los jugadores a seleccionar personas alineadas con sus intereses, al tiempo que les permite cambiar de persona libremente, lo que favorece la autonomía y el compromiso. El juego presenta los mismos objetivos de aprendizaje, pero mediante diferentes estilos de juego para reforzar la retención y la motivación. El estudio adoptó un enfoque de métodos mixtos utilizando encuestas cualitativas previas y posteriores alineadas con indicadores clave de aprendizaje. Se integró una evaluación discreta (*stealth assessment*), basada en el Diseño Centrado en Evidencias (ECD), para evaluar las actividades de aprendizaje en el juego. Los hallazgos revelaron mejoras significativas en los conceptos relacionados con el consentimiento, el mantenimiento y la definición de límites ($p < 0,001$), con tamaños de efecto de medianos a grandes (d de Cohen > 0,5), lo que demuestra la eficacia del juego para mejorar el aprendizaje sobre la seguridad personal.
Palabras clave
Aprendizaje Basado en Juegos, Espacio Personal, Educación en Seguridad, Chatbots de IA, Persona.

1. Introduction

Nevertheless, Child sexual abuse (CSA) in Pakistan is increasingly growing, questioning the systemic failures of preventive measures taken. The Kasur child abuse scandal (2015–2018), involving over 280 minors who were sexually abused and blackmailed, was a national reckoning that drew public outrage. Zainab Alert Act (2020) signified the beginning of legal reforms. This scandal was followed by the Zainab Ansari case (2018), in which a six-year-old girl was abducted, raped, and murdered by a person she knew and trusted. The case not only sparked global condemnation but also catalyzed the introduction of forensic practices and the Anti-Rape Ordinance (2020). Similarly, the Motorway gang rape case (2020) exposed deep-rooted issues of sexual abuse in society, prompting the establishment of Anti-rape Crisis Cells in Punjab (Aurat Foundation, 2021; UNICEF Pakistan, 2020). Parallel to these high-profile cases, child domestic labor abuse remains a chronic issue, reflecting the intersection of poverty, child labor, and CSA. Despite the Punjab Domestic Workers Act (2019), enforcement remains weak, and children under 15 remain unprotected (SPARC, 2023; ILO, 2022). The rise of online CSA and grooming since 2021, including the Federal Investigation Agency's crackdown on over 400 digital predators, marks a new frontier of concern, particularly in under-resourced rural areas. Despite sporadic legal advancements, critical policy and research gaps persist, underreporting driven by stigma, inconsistent implementation of child protection laws, and a lack of trauma-informed mental health services for survivors (Sahil, 2023; Lancet Psychiatry, 2022). These patterns underscore the urgent need for a holistic, well-resourced, and digitally adaptive child protection framework in Pakistan.

This research contributes to persona-driven game-based learning (GBL) for safety education by mapping user personas onto gameplay to enhance learners' engagement and learning. Additionally, this study extends the research on the impact of a chatbot on players' persona selection decisions. Humans have different learning patterns. Research shows that traditional teaching methods lack student engagement (Prensky, 2001; Gee, 2003). Given the growing digital desires of young minds, it is essential to integrate digital tools into education to promote children's safety. The research initially began by exploring existing studies on learning games through the lens of safety education. Its goal was to identify gaps and heuristics for integrating a persona-driven approach into the learning game to improve its effectiveness and enhance player engagement. The study introduces heuristics for persona-GBL integration, including dynamic feedback loops, scenario-based branching (for curiosity and discovery), and reward systems tied to persona-specific behaviors. By leveraging digital interactivity to teach sensitive topics like child safety, this approach not only mitigates the disengagement prevalent in conventional methods but also empowers children to

internalize protective behaviors through experiential, Persona-driven learning. The findings aim to advance the design of educational games by demonstrating how persona-driven customization and chatbot interventions can optimize both engagement and educational efficacy in safety training contexts.

The central research question guiding this study is:

Can persona-based game design enhance player engagement and Learning?

1.1 Background and Context

Child abuse may lead to mental and social disorders, including difficulties in social interactions for a long period of time (Finkelhor *et al.*, 2009; Gilbert *et al.*, 2009). Approximately 40 million children in the world face sexual abuse (Radford & Sommarin, 2014). Child sexual abuse (CSA) cases are increasingly taking place globally, making it a global concern for both developed and underdeveloped countries (Hunt & Broadley, 2020). In Pakistan, more than 4000 CSA cases were reported in 2023 (Sahil, 2023). Sadly, in its 6-monthly report, the NGO published that in 2023, **a** child was sexually abused every 2 hours, resulting in **12 children being abused on average every day (Human Rights Watch, 2023)**. However, these statistics are underreported due to cultural barriers, honor, stigma, and lack of awareness (UNICEF, 2023). On the other hand, sexually abused children may also be reluctant to report, and one of the reasons could be a lack of understanding regarding the different types of sexual abuse (Hunt *et al*, 2020). Addressing CSA is quite challenging in Pakistan due to the economic crisis, societal stigma, and lack of awareness. While we are discussing child abuse, it is important to understand the process and reasons behind child sexual abuse. It is a myth that strangers are the biggest risk to children; however, the truth is that most victims are known to their abusers. 'Child grooming' is a phenomenon in which a person, with the intent of sexual harassment, approaches a child gradually through communication in a favorable environment. Craven *et al.* (2006) discussed various theories of child grooming in detail.

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Figure 1

Steps of child grooming

The steps of the sexual offense process model (Craven, 2006) involve justifying the crime, then going closer to the victim through parents and guardians, preparing the child for abuse, and lastly adopting the grooming strategies, considering the child's behavior.

1.2 Research Aims and Objectives

Since children are the foundation of the future, their security is the most sacred and important duty. It is our collective responsibility to create a world where children are prepared for a brighter and more positive future, making their safety critically important. The following objectives support the aims and help navigate through research questions:

1. **Research Aims**

- **A-1**: To evaluate the impact of a persona-based game design approach on player engagement and learning outcomes
- **A-2:** Develop and test a persona-based game prototype to assess its effectiveness.
- **A-3:** Formulate evidence-based recommendations for persona-driven game design.

2. **Research Objective**

- **O-1:** To determine the boundary of knowledge improvement based on in-game pre- and post-tests. i.e., Consent Score, Boundary awareness Score, and Boundary Definition Score
- **O-2:** To determine the effect on knowledge improvement based on persona selection
- **O-3**: To determine the effect on knowledge improvement based on chatbot consultation.

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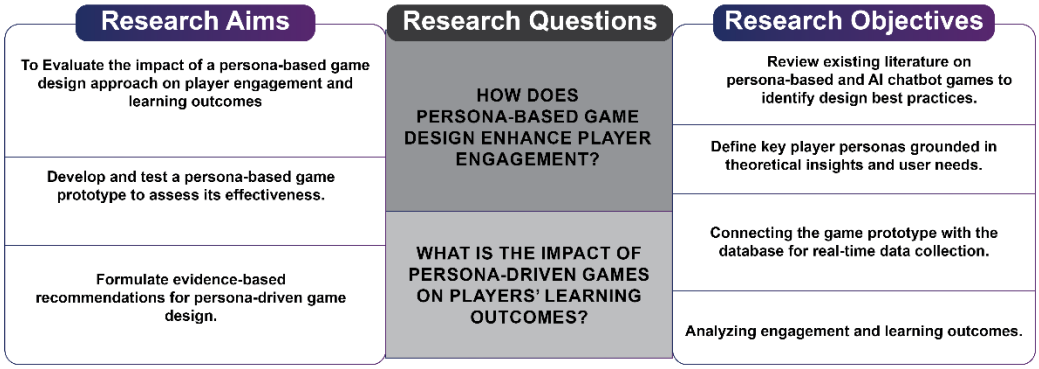
Figure 2

Based on the aims and objectives discussed above, the two key research questions were formulated, focusing on player learning and engagement.



1.3 Attained Objectives

The key knowledge impact factors examined in this research have been attained through a mixed-methods technique. The baseline assessment comprises four core questions assessing initial and post-understanding of personal boundaries through in-game surveys:

- **Conceptual awareness** ("What does personal space mean to you?") with options distinguishing physical space from possessions
- **Consent norms** ("Is it ok to be hugged when you do not want to?") addressing cultural practices in Pakistani families
- **Behavioral responses** ("If someone stands too close...") assessing assertiveness strategies
- **Value attribution** ("Do you think personal space is important?") gauges priority assignment

The study, aligned with the research objective, yielded significant findings (section 4) across three key dimensions: knowledge improvement, persona-based performance, and chatbot efficiency.

1.4 Research Questions

Based on the aims and objectives discussed above, the following research questions were formulated:

RQ-1: How does persona-based game design enhance player engagement?

This research question explores the connection between persona-based game design and players' engagement levels. It focuses on identifying ways to measure players' engagement levels during games.

Objective Alignment*:* supports O-2 and O-3 through a literature review of an existing game and practical implementation through a prototype

RQ-2: What is the impact of persona-driven games on players' learning outcomes?

This question explores how to assess the effects of players' engagement on actual learning. It focuses on identifying the impact.

Objective Alignment: Support O-1, O-2, and O-3 through database connection with the game assessment screens.

1.5 Research Contribution

This work offers a scalable framework adaptable to other domains, enabling EdTech solutions for future innovations in safety education and beyond. The research work aims to contribute to the following:

1. **Persona-based framework:** Unlike traditional teaching methods, the game presents identical learning objectives through persona-based variations, allowing children to select or switch personas freely, prioritizing learning over rigid gameplay structures.
2. **Trauma-informed design (TID):** The game is designed to minimize trauma and fear associated with safety awareness education, and subliminal positive reinforcement rewards are used to encourage a safe and motivating learning environment. This approach aligns with child safety principles, reducing fear while reinforcing learning critical and sensitive topics like personal safety.

2. Literature Review

Learning games, which foster fun and motivation, are very effective learning methods (Pramesti *et al.*, 2025; Richter *et al.*, 2025; Cheng *et al.*, 2013). Games can be a powerful tool for inclusive learning. We usually assume that a learning game is a 'serious game' (Abt, 1970), but previous studies have shown that fun games are more likely to be an effective motivator for learning (Gee, 2003; Prensky, 2001).

No single game design approach can fit the learning needs of all. Self-confidence and role-play games define the game's efficacy (Zheng *et al.*, 2025; de Vette *et al.*, 2016). The term 'intrinsic motivation' of a game reflects the idea that the player is engaged in the game without the need for an external reward. The player is involved in the game for the sake of 'fun.' Personal motivation is, without a doubt, important in learning (Malone *et al.*, 1981). The Framework for a Theory of Intrinsically Motivating Instruction by Malone discusses Challenges, Fantasy, and Curiosity as the

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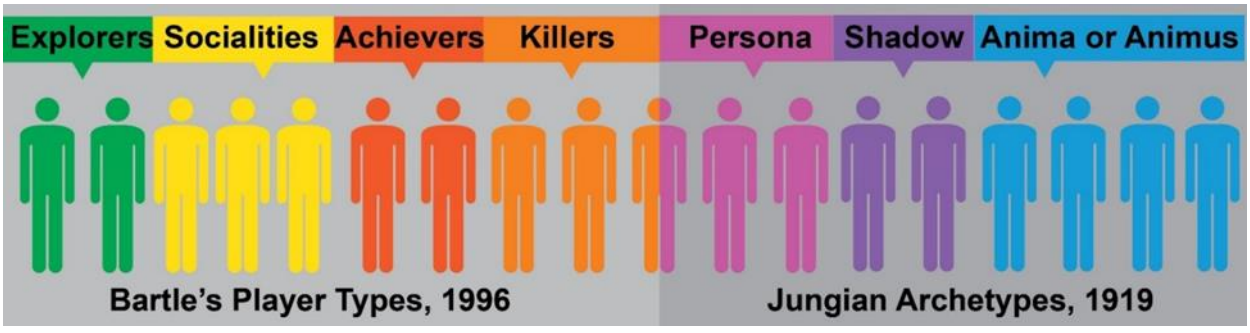
main motivators in games. Motivation is an important factor in enhancing students' learning processes (Chen *et al.*, 2003; Carless, 2006). Gamification involves creating experiences that incorporate elements of games, including mechanics, visuals, assets, rewards, levels, storytelling, and design processes, to enhance learning (Kapp, 2013; Deterding *et al.*, 2011). In his book 'The Gamification of Learning and Instruction, the author discusses two types of gamification: Structural gamification is when the game design elements, like badges and scoring, are used during a lecture or completing an assignment, whereas in content gamification, the game design approaches are applied to make existing information into a game-like content. Gamification concerning the integration of AI and adaptive learning is an emerging theme (Mushtaq *et al.*, 2025).

The 'persona-driven' game design methodology aims to align with players' hidden personality traits. The idea behind this transformative approach can be traced back to the work of Isabel Myers and her mother, Katherine Briggs, who developed the Myers-Briggs Type Indicator (MBTI) in 1962. The 16 personality types are based on Carl Jung. These 16 player types are further divided into 04 dichotomies. This theory is still widely practiced but also criticized for oversimplifying human personality. 'Bartle's taxonomy of player type' (1996) identified four primary personas, each representing a different motivation for an effective gameplay experience. (Park *et al.*,2021). The scope of this study is limited to the four personas presented by Bartle.

Figure 3

Spectrum of Personalities - Carl Jung presented the concept of 'persona' as a mask, whereas Richard Bartle suggested four personality types of game players.



However, this idea was criticized for two reasons: first, players' motivations and personality preferences may change over time and with age, and second, we cannot draw a clear distinction among personality types, since a curious person may also like to kill (Tondello *et al.*, 2016). Based on Bartle's theory, Yee (2002; 2006; 2007) suggested that player personality types fall into three

categories, i.e., Achievement, social, and immersion, which are further divided into 10 subcategories. Yee's 'Motivations of Play in Online Games' addresses the criticism Bartle's personality types faced, but also includes some of his work as well.

Marczewski's user/player types, the Hexad Scale (Marczewski, 2015), suggest six player types for gamification. Out of these six personalities, Philanthropists, Achievers, Free Spirits, and Socializers are Intrinsic, while Players and Disruptors are Extrinsic. (Gustavo *et al.*, 2016) Created a survey response to assess user preferences against Marczewski's user/player types. Based on Marczewski's user type hexad framework (Akgün *et al.*, 2018), the Gamification User Types Hexad Scale (GUTHS) was developed in Turkish.

Table 1

The prominent theories of game archetypes (Player types)

Sr#	Myers-Briggs Type Indicator (1962)	Thomas Malone's Theory of Intrinsic Motivation (1981)	Richard Bartle (1996)	Nick Yee Gamer types (2002)	Marczewski's Hexad Scale (2015) for gamification
1	**Introversion** vs. **Extraversion**	**Challenges** (accepting tasks with uncertain outcomes)	**Achievers** (Desire for mastery)	**Achievement** (desire for more)	**Achievers** (Complete all the challenges/ levels)
2	**Sensing** vs. **Intuit**	**Curiosity** (seeking further knowledge)	**Explorers** (discovering the secrets)	**Immersion** (Fantasy)	**Free Spirits** (independently explore the environment)
3	**Thinking** vs. **Feeling**	**Fantasy** (such as role-playing or simulations)	**Socializers** (building relationships)	**Social** (community)	**Socializers** (interacting with others)
4	**Judging** vs. **Perceiving**		**Killers** (dominating others)		**Disruptors** (They trigger change)
5	-	-	-	-	**Philanthropists** (helping others)
6	-	-	-	-	**Players** (desire extrinsic rewards like rewards, leaderboards)

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Figure 4

Prominent player-type frameworks. The figure justifies the selection of Bartle's four personality types for the scope of this research.

Bartle's taxonomy of player type	Malone	Yee	Marczewski
Achievers	●	●	●
Explorers	●	●	●
Socializers	●	●	●
Killers	●	●	●

(Conde, 2020) developed a game to educate individuals with disabilities about boundary violations through scenario-based learning, while ECHOES (Bernardini *et al.*, 2014) used digital characters to teach communication skills to autistic children. Digital tools like The Circles App (2016) and Google's 3D low-poly game 'Interland' leveraged interactive platforms to teach social safety and internet etiquette. Pakistan's Digital Hifazat (2023), which combined games, comics, and workshops for child safety awareness. (Vergari *et al.*,2022) further examined personal space perception in augmented reality, highlighting the role of avatar design in boundary education. Many commercial games have integrated persona-driven mechanics through questionnaires or adaptive narratives. Games like Fallout 3 (2008), The Sims 4 (2014), and Moon Hunters (2016) used personality traits to shape gameplay, while Until Dawn (2015) tailored horror experiences based on players' perception of fears. Pokémon Mystery Dungeon (2020) and *999* (2009) employed quizzes aligned with psychological frameworks such as the Enneagram (Riso & Hudson, 2000) and the MBTI (Myers & McCaulley, 1985) to assign personas, thereby influencing story outcomes. Similarly, Danganronpa (2021) and Tomodachi Life (2023) adapted character interactions to MBTI types, demonstrating how persona-based design enhances player engagement.

A 'chatbot' is a virtual assistant that provides services via text or audio (Brennan, 2006; Chopra *et al.*, 2016). Research has proven that learners cannot develop general or specific subject knowledge without debriefing and reinforcement (Shinogaya, 2012; Sanchez, 2011; Habgood, 2007; Garris *et al.*, 2002). Virtual assistants can be fun, motivating, and effective helpers or guides for learning. Students interacting with the virtual assistant can perform better than their instructors (Essel *et al.*, 2022). Chatbots have immense potential (particularly with large language models (LLMs)) across a range of topics, and they can serve a spectrum of students (Fryer & Carpenter, 2006). Recent

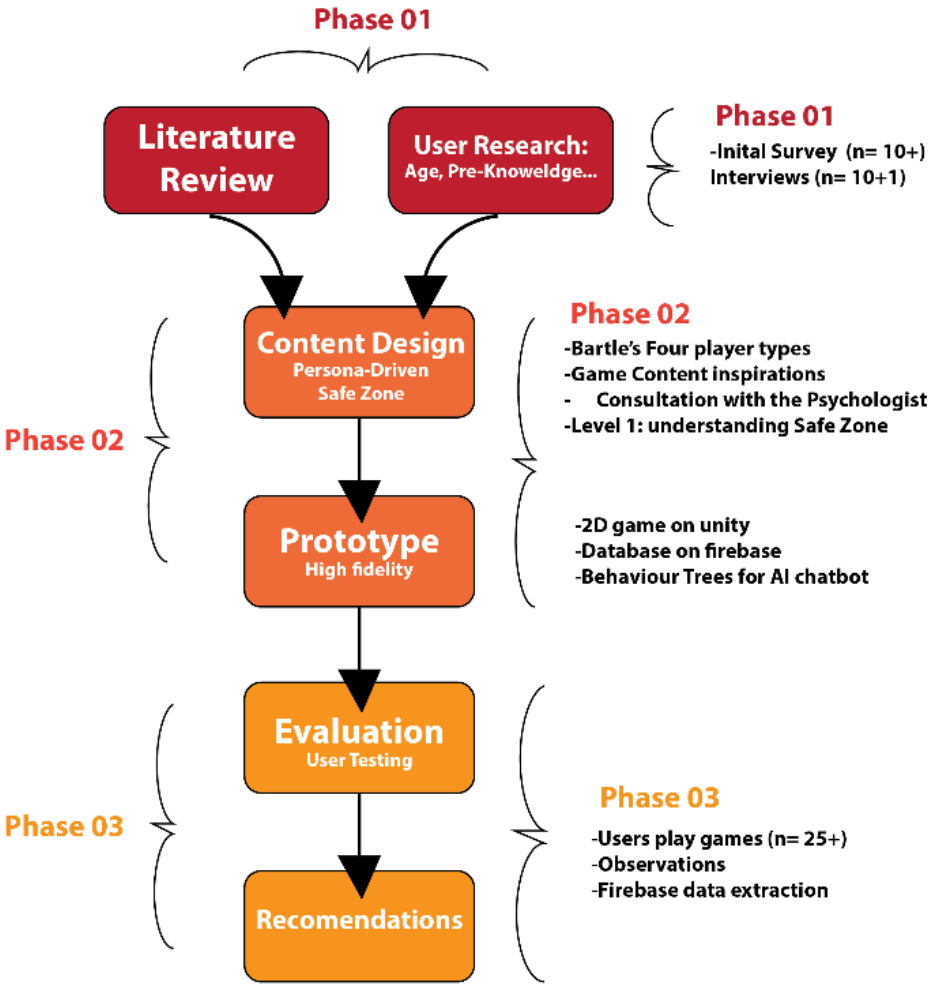
developments have enabled users to build and train their chatbots across multiple platforms, including AWS, Google Cloud, and others.

3. Methodology

The Research Phases involved reaching out to the target population and engaging them in discussions about their fears and knowledge of personal boundaries and safe zones. The feedback gathered was in the form of drawings. Children can easily express their internal emotions and fears, which are hidden in the right hemisphere of the brain, through drawing, thereby converting them into artwork (Malchiodi *et al.*, 2011). The second phase of the research was instructional design, prototype design, and development. Existing online resources inspire the game content. The last phase of the research involved user testing and data evaluation.

Figure 5

Flow diagram of the phases of the research design



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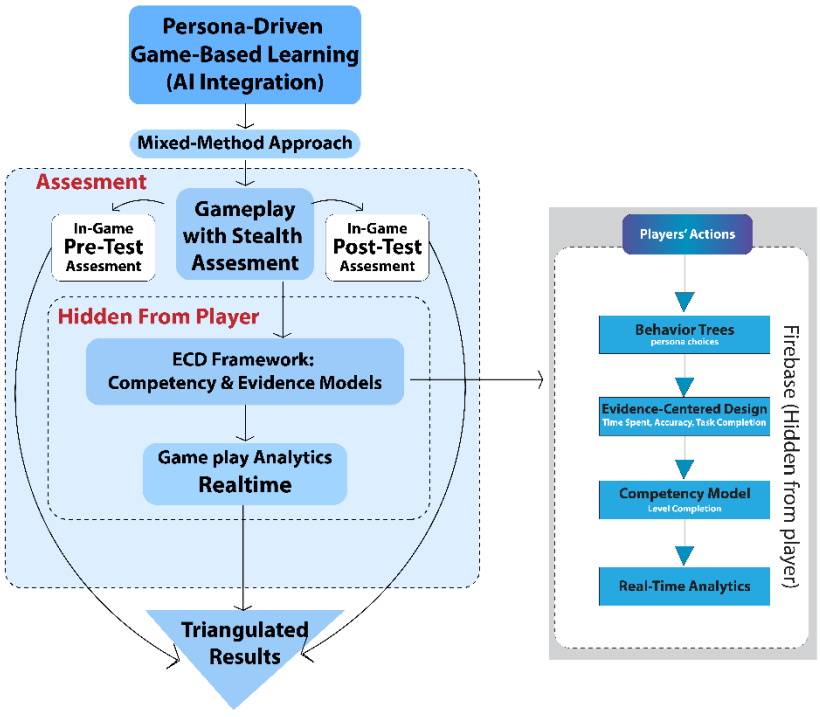
This study employs a mixed-methods approach (quantitative + qualitative) within a pragmatic research paradigm (Tharsika & Pratheepkanth, 2020) to evaluate the effectiveness of personality-driven GBL. The methodology aligns with established frameworks for assessing learning outcomes using pre- and post-game surveys linked to key assessment indicators (Alonso-Fernandez *et al.*, 2017). The study employed an evaluation framework that combined qualitative and technology-based assessment methods to comprehensively measure learning outcomes. The core evaluation followed Cook and Campbell's (1979) one-group post-test model (Krishnan, 2024), with knowledge assessments administered at two critical junctures. Participants completed a pre-test at the start of gameplay, followed by systematic post-testing after completing each gameplay level and persona segment. This design enabled direct measurement of knowledge acquisition while maintaining ecological validity within the game environment.

Figure 6

Flow diagram of the Proposed Research Methodology. The pre- and post-assessments are conducted through an in-game survey.



The methodology (see Figure 6) is based on a mixed-methods approach to evaluating learning outcomes in GBL, using AI-driven analytics and evidence-centered design. Therefore, this study combines gameplay data, stealth assessment, and competency modeling to explore player

performance and learning. The assessments incorporate an in-game pre-test to assess players' prior knowledge. After gameplay, players take an in-game post-test assessment to check learning differences. Finally, comparing pre- and post-test results helps determine the efficacy of the persona-driven GBL intervention. The stealth assessment model employed an evidence-centered design (ECD) framework, ensuring personalized learning experiences tailored to individual players' needs. Finally, the data analysis validates whether observed behaviors align with expected competency models and confirms that in-game decisions correlate with demonstrated knowledge.

Stealth assessment is a blend of performance data collected during gameplay. This method helps to evaluate players in a natural, engaging environment without disrupting the game immersion. The Evidence-Centered Design (ECD) framework complements stealth assessment. which structures assessment around three key models, i.e., 1) Competency Model: Defines the skills and knowledge being assessed, 2) Level Completion: Measures progression through game levels as a measure of skill mastery indicator, and 3) Real-Time Analytics: AI processes gameplay data instantaneously, allowing for dynamic adjustments in difficulty or feedback. This ensures personalized learning experiences tailored to individual players' needs. Finally, triangulated analysis is used to validate whether observed behaviors align with expected competency models and to confirm that in-game decisions correlate with demonstrated knowledge. Overall, this persona-driven, game-based learning methodology establishes a robust model for evaluating and improving educational outcomes.

Finally, triangulated analysis is used to validate whether observed behaviors align with expected competency models and to confirm that in-game decisions correlate with demonstrated knowledge. Overall, this AI-integrated, persona-driven, game-based learning methodology establishes a robust model for evaluating and improving educational outcomes.

3.1 Research Assessment

The Research methodology involves a stealth assessment framework for GBL. Real-time data on in-game activities is collected and stored in Firebase. The triangulated data, which includes in-game pre- and post-tests, qualitative observations, and an assessment of in-game actions, is evaluated through the ECD framework. The two KPIs of the project are learning and engagement:

Table 2

Core Research Assessment Indicators

Key performance indicators (KPI's)	Description	Measurement Method
Trait 1: Learning	Knowledge of 'safe zone.'	Pre/post gameplay questionnaires
Trait 2: Engagement	Engagement, persistence & curiosity	Observational checklists, Real-time gameplay analytics.

Incorporating a stealth assessment framework (Shute & Ventura, 2013) captures authentic learning processes. This approach embedded assessment frameworks into gameplay through three key metrics:

1. Knowledge improvement (measured via pre-test/post-test t-tests)
2. Persona-based learning gains.
3. Chatbot-mediated knowledge acquisition.

In a stealth assessment, evaluation mechanisms are directly integrated into gameplay to measure skills without disrupting the user experience. While the pre- and post-test approach has limitations, combining it with data analytics and qualitative feedback (stealth assessment) helps address key concerns about validity.

Table 3

The research design combines pre- and post-tests with a stealth assessment approach (Shute et al., 2017) and is complemented by qualitative user feedback from game players.

Methods	Strengths	Limitations	How They Work Together
Pre/Post Tests	Standardized, easy to analyze.	Self-report bias (game players may give "expected" answers)	Provide explicit measures of learning (e.g., "I now understand boundaries").
Stealth Assessment (2017).	Real-time behavior tracking.	Requires analytics infrastructure, e.g., Firebase, in this scenario	Reveals implicit learning (e.g., the player spent more time selecting a persona).
Qualitative Feedback of the players (participatory approach)	Explains the reason behind specific actions within the game	Small sample bias	Adds context to in-game actions (e.g., interviews explain why certain personas were preferred).

3.2 Evidence-Centered Design (ECD) Framework

The evidence-centered design framework (Mislevy, 2003) was adopted as its foundational assessment methodology, particularly suited for evaluating complex assessments. The framework's four structural components were adapted to the game-based learning context as follows:

1. **Domain Analysis** established the theoretical foundations of personal boundary education through a literature review and expert consultation
2. **Domain Modeling** mapped the relationship between gameplay mechanics and targeted competencies.
3. **Conceptual Assessment Framework** specified how in-game behaviors would serve as evidence for learning, and Operational Assessment implemented the data collection protocols through integrated game metrics. This ECD approach enabled the simultaneous evaluation of cognitive learning outcomes and behavioral engagement levels, with player competencies inferred from the systematic analysis of in-game actions. The methodology particularly addresses the need for authentic assessment in immersive learning environments, where traditional measurement tools may fail to capture the full spectrum of skill development and engagement.

Figure 7

Core components of ECD applied to the Stealth Assessment Framework.

3.3 Research Population and Sampling

Purposive sampling was used to select the test sample for this research. The intervention took place at a local public school with children aged 6–10. Before testing, parental consent was obtained through the school administration, and five evaluation officers were trained to standardize adherence to the protocol and observational assessments. The purpose of selecting this age group is that children in this range are typically in elementary school and experiencing significant physical, social, and cognitive development. Children of all ages are reportedly vulnerable to abuse; however, the Sahil Cruel Numbers, 2023 report states that, in Pakistan, during the past few years, both girls and boys,

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aged 6–15, are comparatively more victimized than other age groups. According to the investigation report of the National Commission for Children, the frequent CSA victims in Kasur district are between 5- and 9-year-old children who are entrapped by the gangs and then involved in the CSA incidents. The game was designed with the research sample in mind. The gameplay and core mechanics are kept simple, and the pre- and post-surveys include images to aid understanding.

Figure 8

User testing of the game prototype

3.4 Scope and Process of Level Design

The concept of personal boundaries is often narrowly perceived as relating solely to physical space. The invisible perimeter around one's body that determines comfort with touch or proximity, there are other types of personal boundaries as well, i.e., emotional, social, digital, and material boundaries. Social boundaries are defined as social interactions and others' personal space. Digital boundaries involve appropriate online interactions. The emotional boundary involves taking care of others' feelings and mental health, such as bullying or manipulation. At the same time, material boundaries are personal possessions of physical resources. Before children are introduced to these boundary types, they must first develop a fundamental understanding of personal boundaries. The personal boundary is a universal right: everyone has the right to define limits and express comfort levels in various situations. Foundational awareness of boundary concepts is the critical first step in boundary education, enabling children to understand that boundaries are adaptive tools for self-protection and healthy relationships. With this basic understanding of personal boundaries, children can grasp more complex concepts of boundaries and self-protection, such as distinguishing between safe and unsafe situations. The current research focuses on Level 1, the 'Safe Zone', which is designed to teach children the foundational concept of personal space through interactive gameplay. The game presents a universal scenario in which personal space is depicted as protective, using visual and

auditory feedback to reinforce correct boundary-setting behaviors without punitive measures for mistakes, aligning with positive child development principles.

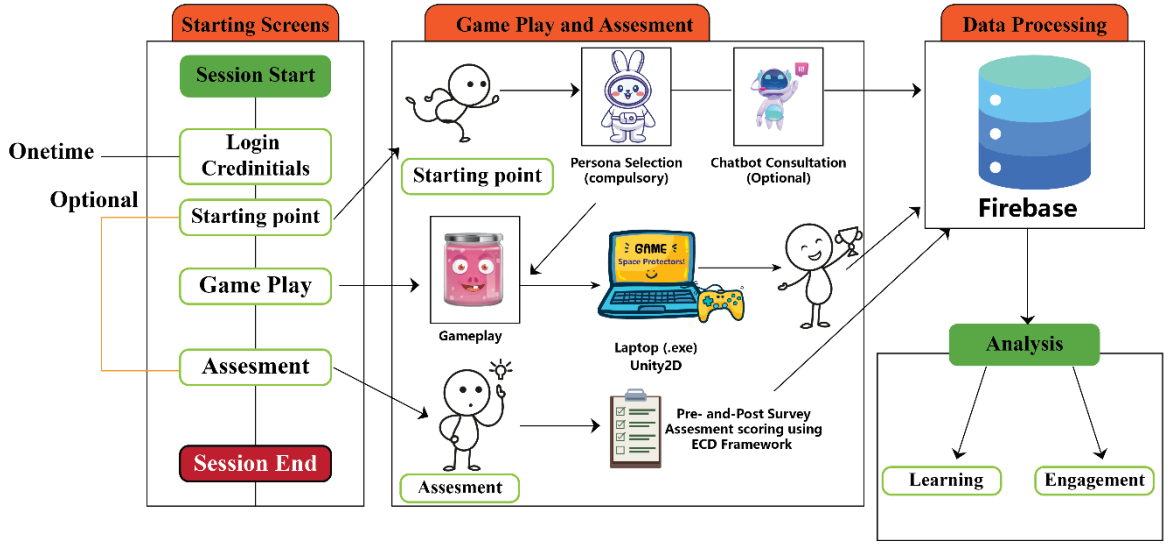
Figure 9

Game Levels. The research focuses on level 1, which includes the 'trust zone.'

Gameplay mechanics are designed to support experiential learning, allowing children to practice their understanding of personal boundaries in a controlled game environment before applying these concepts in real-world interactions. A 2D game, "Space Protectors: My space, my rules," is a space-themed educational game developed in Unity, while Firebase was integrated for real-time data. The game design incorporates key psychological principles, including a non-punitive learning approach where incorrect answers prompt supportive feedback, aligning with Self-Determination Theory's emphasis on positive reinforcement (Ryan, 2000).

Figure 10

The diagram illustrates the complete game flow.



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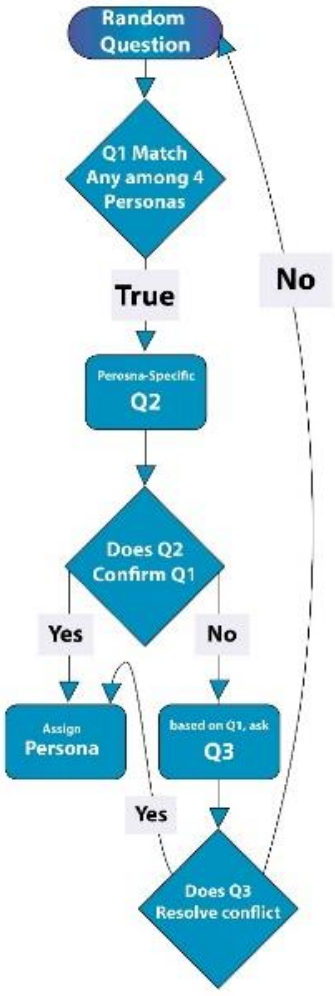
The user logs in to the game using the guardian's name and details and is asked to complete a pre-survey. Then, the child selects a preferred persona or consults the chatbot. The app is connected to Firebase, which stores real-time data, including Player identification and Gameplay variables (e.g., Person selected, Level Completed). Pré/Post Assessment scores: Consent Score, Boundary awareness Score, Boundary Definition Score, Interaction metrics: Time in seconds, Chatbot consulted, and Chatbot followed. The chatbot uses behavior tree architecture to guide persona selection. This deterministic system operates through predefined decision trees developed by generative AI using the room2educate framework (Fotaris *et al.*, 2023). The chatbot initiates interaction with a general opening question, then progresses through tiers of persona-specific inquiries based on player responses. The Firebase data is analyzed through the data analysis tool JASP.

Figure 11

Behavior tree model of the Chatbot.



3.5 Game Play and Game Mechanics

The scope of this game is limited to level 1, named the ‘safe zone.’ To protect their personal space, our little players must understand the concept of it. The player is visualized as an arm-length bubble activated by the "Stretch Arm" button. Keeping the age group in mind, we are targeting parents/siblings who may enter their safe zones. The arm-stretching game mechanic is universal across all personas.

Figure 12

The 'arm stretch' mechanic serves as a unified gameplay activity across all four people to reinforce the ‘safe zone’ concept consistently

The gameplay of this interactive experience is designed according to the Conscientiousness Model (McCrae & Costa, 1987) to engage players through a series of activities that align with their distinct behavioral traits, as demonstrated by the four unique personas: Curious Panda, Fighter Fox, Social Bunny, and Collector Koala. Each character embodies specific engagement indicators, ensuring a dynamic and immersive play environment. The game is designed so that when an answer is incorrect, the screen will not advance, supporting a non-punitive learning approach (Ryan, R. M., & Deci, E. L., 2000). When positive feedback is provided, it highlights motivation. All four persona-based characters complete 4-5 boundary-setting questions to unlock certificates of level completion.

3.6 Bartle’s Persona-Driven Game Design

Persona-driven game design offers a player-centered approach, aligning gameplay mechanics with distinct motivational profiles. Drawing inspiration from Bartle’s (1996) taxonomy of player types – Killer, Achiever, Socializer, and Explorer – this game incorporates four unique characters designed to support learning about personal boundaries in engaging, developmentally appropriate ways.

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The original Bartle's personality types are Killer, Achiever, Socializer, and Explorer. The game characters aligned with Bartle's personas are as follows: Killer: Fighter Fox; Achiever: Collector Koala; Socializer: Social Bunny; and Explorer: Curious Panda. Each persona's gameplay is designed using the same pedagogical strategies, tailored to that persona's distinctive personality type.

The gameplay includes unified design elements, such as the "safe zone" bubble visualization used by all personas. Incorrect answers trigger tailored feedback, and Cross-persona Items are used in gameplay for uniformity; for example, incentives collected by Koala may appear in Panda's puzzles.

The tailored gameplay mechanics for each game persona are as follows:

1. Curious Panda (Explorer)

- **Personality:** Inquisitive and adventurous, Panda represents Bartle's explorer archetype and engages players through mechanics to build curiosity.
- **Core Game Mechanics:** The gameplay helps players understand the concept of personal space through a visualized 'boundary bubble' (at arm's length) activated by a stretch-arm button. The game includes consent-based scenarios, like accepting gifts from family, relatives, or strangers. The persona unlocks mini-puzzles, a spin-wheel, and other incentives during gameplay. Incorrect choices trigger pop-ups that offer mini-games to reinforce the concepts, aiding self-reflection and correction.
- **Key Features:** The scenarios involve staying closer to family, building trust in family relationships, avoiding accepting gifts or favors from people who aren't necessary, and using a spin wheel to teach children what constitutes a safe person.

2. The Fighter Fox (Killer)

- **Personality:** Brave and action-oriented, Fox embodies Bartle's killer persona through assertive, goal-focused gameplay. This character uses protective and combat mechanics to simulate defending oneself and others from strangers and untrusted people.
- **Game Mechanics:** The Players use 'Boundary bubbles' to make enemies who try to spread harmful or secretive messages disappear, metaphorically representing manipulative behaviors. A child must be aware of persons who tell them to keep secrets, since there is a difference between keeping secrets and surprises. Gameplay encourages critical decision-making by prompting players to categorize other characters as family, friends, or strangers and to place them inside or outside a designated safety circle. Poor judgment triggers

educational pop-ups that teach age-appropriate concepts like manipulation, personal rights, and safe disclosure practices.

- **Key Features:** The subliminal messages are delivered through a secret-keeping monster and by avoiding unnecessary or unwanted people.

3. The Social Bunny (Socializer)

- **Personality:** An outgoing, sociable bunny may exhibit inappropriate or intrusive behavior. The Social Bunny represents the Socializer persona and is ideal for teaching boundaries to children who are quite an extrovert in nature. The character explores gameplay scenarios to understand when and how to engage appropriately with others.
- **Core Game Mechanics:** The persona encounters scenarios in which the player must think before allowing others into the personal boundary bubble.
- **Key Features:** The core concept revolves around 'consent seeking'. The social bunny is presented with game scenarios involving intrusive and extroverted behaviors.

4. The Collector Koala (Achiever)

- **Personality:** Conscientious and goal-oriented, the koala thrives on reward. The Collector persona is designed for players who are motivated by progression, consistency, and tangible outcomes.
- **Core Game Mechanics:** Players collect items like coins, bubbles, and treasure chests through repetitive yet increasingly complex tasks. These tasks involve goal setting and task persistence. The gameplay scenarios support environmental exploration as an incentive.
- **Key Features:** Achievement-based badges, like "Focus Finisher" or "Goal Guardian," are awarded for consistent task completion.

4. Discussion and Recommendations

4.1 Knowledge Gain Outcomes

The t-test (Table 5) was conducted to determine whether the mean score on the in-game survey for each identified knowledge domain significantly improved after participation in the game-based learning activity. A paired-sample t-test is best suited because the same sample is tested before and after the intervention.

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Table 5

T-Test results based on in-game pre- and post-test

Knowledge Improvement Outcomes	t	df	p
Consent Awareness	3.681	26	0.001
Personal Boundary Awareness	4.104	27	<0.001
Personal Boundary Definition	5.391	27	<0.001

The t-value shows the size and direction of the difference between pre- and post-test scores. A higher absolute t-value suggests a larger difference. df (degrees of freedom) indicates the number of independent values in the dataset that can vary, calculated as (n - 1). The p-value identifies whether the observed difference is statistically significant. A value less than 0.05 typically indicates a statistically significant result.

There is a statistically significant improvement in participants' understanding of consent awareness ($t = 3.681$, $df = 26$, $p = 0.001$) after the game. There was a very significant increase in awareness of personal boundaries ($t = 4.104$, $df = 27$, $p < 0.001$). The t-value is even higher than that for consent awareness, and the p-value is less than 0.001, indicating strong statistical evidence of improvement.

The high t-value and very low p-value ($t = 5.391$, $df = 27$, $p < 0.001$) show that the game had a very strong impact on participants' ability to define the concept of 'personal boundaries.

All three knowledge gain outcomes show statistically significant improvements after the intervention. The game-based learning method appears to be highly effective, especially in helping players articulate and define personal boundaries. The progressive increase in t-values (from awareness to definition) might suggest a deeper cognitive engagement as players moved from recognizing concepts to defining them.

4.2 Persona-Based Knowledge Outcomes

Table 6 presents descriptive statistics on knowledge improvement scores segmented by player persona types (Curious, Fighter, Social, Collector). It covers three learning dimensions: Consent Score, Boundary Score, and Boundary Definition.

Table 6

Descriptives: correlation between persona-based play styles and learning performance.

Persona Performance	Persona	N	Mean	SD	SE	Coefficient of variation
Consent Score	Curious	9	0.944	0.167	0.056	0.176
	Fighter	6	1.000	0.000	0.000	0.000
	Social	6	0.917	0.204	0.083	0.223
	Collector	11	0.955	0.151	0.045	0.158
Boundary Score	Curious	9	0.889	0.220	0.073	0.248
	Fighter	6	1.000	0.000	0.000	0.000
	Social	6	0.917	0.204	0.083	0.223
	Collector	11	0.955	0.151	0.045	0.158
Boundary Definition	Curious	9	0.889	0.220	0.073	0.248
	Fighter	6	0.917	0.204	0.083	0.223
	Social	6	0.833	0.258	0.105	0.310
	Collector	11	0.909	0.202	0.061	0.222

In the consent knowledge score, the Fighter Fox performed best, achieving a perfect score. Collector Koala and Curious Panda also performed very well, with high means and low variability, indicating high, consistent learning. Social Bunny had the lowest average and highest variability, suggesting some children benefited less from the GBL. For the Boundary knowledge score, Fighters once again show perfect knowledge acquisition. Collectors are a close second with both high means and consistency. The Curious and Social personas showed greater variability, indicating inconsistent learning outcomes. For boundary-definition scores, social bunny showed the least improvement and the greatest inconsistency in boundary definition. Fighter Fox dropped from top performance but still maintained strong definition scores. Collector Koala continued to demonstrate balanced, consistent performance across all outcomes.

The Descriptive statistics (Table 6) showed that the Fighter and Collector personas achieved marginally higher boundary scores than the Curious persona. Curious Persona performed well, but with slightly higher variability. Personalized feedback or structured prompts might benefit the Social Persona, which had lower average scores and greater variability, especially in Boundary Definition. This could reflect challenges in individual learning among socially driven players. Social persona players benefit more from collaborative or peer-driven gameplay. The above statistical data findings provide robust evidence for the research objective (O-2), suggesting that tailoring game design to suit diverse player types could optimize learning outcomes.

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4.3 Chatbot Consultation Knowledge Gain Outcome

Table 7 shows the mean knowledge improvement scores for two groups. The chatbot was optional, and since a single player may play for multiple sessions, those who did not use the chatbot ("No") are more (n=29) as compared to those who used the chatbot ("Yes"), where N= 11

Table 7

Descriptives – Chatbot Consultation

Chatbot Used	N	Mean	SD	SE	Coefficient of variation
No	29	1.069	0.258	0.048	0.241
Yes	11	1.818	0.405	0.122	0.222

Table 8

ANCOVA - Chatbot Consultation Knowledge Gain Outcome

Cases	Sum of Squares	df	Mean Square	F	p
Persona	0.595	3	0.198	2.390	0.085
followed Chatbot	4.958	1	4.958	59.762	< .001
Residuals	2.904	35	0.083		

The chatbot significantly enhanced learning efficacy across all personas (TABLES 6 & 7). Players who followed the chatbot's guidance (n=11) consistently outperformed their self-guided peers (n=29), highlighting the chatbot's role as a critical scaffold for adaptive learning. On average, guided learners demonstrated a 70% higher knowledge improvement score (M=1.818) than non-guided learners (M=1.069). Despite greater individual variability, the guided group showed a better overall performance.

To ensure this improvement was not merely a reflection of persona-based differences, ANCOVA was applied to control for potential confounding effects of player persona. This data analysis method allowed us to isolate the impact of chatbot usage on learning outcomes while adjusting for variation introduced by different play styles. The analysis revealed that chatbot usage was a statistically significant predictor of knowledge gains ($F=59.76$, $p<.001$), whereas persona differences were not ($p=0.085$).

These findings provide robust evidence for the research objective (O-3), demonstrating that the in-game educational intervention, especially when paired with chatbot support, substantially improved learning outcomes across all measured dimensions, regardless of persona.

5. Conclusion and Recommendations

5.1 Conclusion

The statistical results make significant contributions to the field of GBL, not only within the Pakistani context but also to diverse cultural contexts. Robust gains in knowledge scores are observed across all measured knowledge domains, providing compelling evidence of the persona-based game's effectiveness in an educational context. The results break new ground by applying these principles to safety education in developing nations such as Pakistan, where such approaches remain underexplored.

While all persona types showed improvement, the marginally higher performance trend among Fighter and Collector personas suggests that people with related characteristics may retain knowledge better than those with other personality archetypes. For Social Persona, a collaborative, peer-driven approach is recommended. Interestingly, persona type had no significant effect on time efficiency, confirming that time savings did not compromise accuracy and that performance quality remained consistent.

The chatbot integration successfully demonstrates that intelligent assistance systems can significantly enhance learners' efficiency and motivation. Furthermore, the framework's demonstrated adaptability suggests promising applications across various EdTech domains, from digital safety to health and environmental pollution awareness programs.

5.2 Recommendations

The study indicates promising results, but certain limitations, such as a relatively small sample size and a short-term assessment design, raise questions about long-term knowledge retention. **Future research should focus on longitudinal studies to examine knowledge retention over time**. Future work includes exploring longitudinal studies tracking real-world behavior changes in school settings, which are essential next steps. Concurrently, develop adaptive AI that dynamically adjusts personas based on real-time performance data. Accessibility expansions, such as making the game available online, can enhance effectiveness by reaching a broader audience and allowing children to explore it independently at home. The persona-driven game can bring remarkable disruption in the field of

special education. Differently abled people are more prone to abuse than others. This research can be extended to incorporate persona types for the mentally challenged children and adults.

5.3 Future Research Directions

Building on the foundational persona-driven framework for the GBL, this study proposed a tiered level design to scaffold children's understanding of personal. The general concept of the 'Safe zone' introduces the core concept of personal space as an invisible boundary, represented by the fragile bubble. **Future research may extend to the next game levels**, targeting specialized competencies:

- The 'Space Invaders zone' distinguishes space protectors from invaders through decision-making challenges.
- The 'Emotional zone' addresses psychological boundaries by simulating bullying scenarios and teaching coping strategies like assertiveness and reporting.
- The 'Physical zone' includes education on the concepts of good and bad touch.
- Social dynamics are explored in the 'Friends zone,' which includes reinforced consent and shared space rules.
- To address modern risks, the 'Digital zone' incorporates cyber-safety modules on grooming and privacy.
- The 'Strange' zone prepares children for real-world threats through crisis-response scenarios.

Finally, **explore 'persona-blending' prototypes to merge the efficiency of a fighter with a collector's real-world skill application.** This framework establishes AI-guided persona learning as a transformative model for boundary-setting education, with immediate scalability potential in global educational contexts.

6. References

1. Akgün, Ö. E., & Topal, M. (2018). The Turkish adaptation study of the Gamification User Types Hexad Scale. *International Journal of Assessment Tools in Education, 5*(3), 389–402. https://doi.org/10.21449/ijate.379139

2. Al Jazeera. (2023, August 25). *A child was sexually abused every two hours in Pakistan this year: NGO says*. https://www.aljazeera.com/news/2023/8/25/a-child-was-sexually-abused-every-two-hours-in-pakistan-this-year-ngo-says

3. Alonso-Fernandez, C., Calvo, A., Freire, M., Martinez-Ortiz, I., & Fernandez-Manjon, B. (2017). Systematizing game learning analytics for serious games. *2017 IEEE Global Engineering*

Education Conference (EDUCON), 1111–1118. https://doi.org/10.1109/EDUCON.2017.7942988

4. Altmeyer, M., Tondello, G. F., Krüger, A., & Nacke, L. E. (2020). HexArcade: Predicting Hexad user types by using gameful applications. *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*, 219–230. https://doi.org/10.1145/3410404.3414232

5. Amnesty International. (2018). *Pakistan's failure to protect children*. https://www.amnesty.org

6. Andrus, K. H. K. (2018). Personality & game design preference: Towards understanding player engagement and behavior. *Journal of Game Design and Development Education, 8*(2), 45–60.

7. Aurat Foundation. (2021). *Annual report on violence against women and children*. https://www.af.org.pk

8. Bahlol, F. A., & Al-Samarraae, A. A. S. (2025). Relationships between social anxiety, childhood sexual abuse, and symptoms of post-traumatic stress disorder in women. *Biomaterials Translational, 6*(1), 27–43.

9. Bakkes, S., Tan, C. T., & Pisan, Y. (2012). Personalized gaming: A motivation and overview of literature. *Journal of Creative Technologies, 1*(1). https://doi.org/10.1145/2336727.2336731

10. Bartle, R. A. (2009). From MUDs to MMORPGs: The history of virtual worlds. In *International handbook of internet research* (pp. 23–39). Springer. https://doi.org/10.1007/978-1-4020-9789-8_2

11. Brennan, K. (2006). The managed teacher: Emotional labor, education, and technology. *Educational Insights, 10*(2), 55–65.

12. Carless, D. (2006). Differing perceptions in the feedback process. *Studies in Higher Education, 31*(2), 219–233. https://doi.org/10.1080/03075070600572132

13. Chen, Y., & Hoshower, L. B. (2003). Student evaluation of teaching effectiveness: An assessment of student perception and motivation. *Assessment & Evaluation in Higher Education, 28*(1), 71–88. https://doi.org/10.1080/02602930301683

14. Cheng, Y.-M., Lou, S.-J., Kuo, S.-H., & Shih, R.-C. (2013). Investigating elementary school students' technology acceptance by applying digital game-based learning to environmental education. *Australasian Journal of Educational Technology, 29*(1). https://doi.org/10.14742/ajet.65

15. Chopra, A. K., Avhad, V. D., & Jaju, S. (2016). Chatbot as a personal assistant. *International Journal of Computer Applications, 148*(12), 36–40. https://doi.org/10.5120/ijca2016911434

16. Conde, S. (2020). Establishing a serious game on relationship boundaries for people with developmental disabilities. *Proceedings of the 22nd International ACM SIGACCESS Conference on Computers and Accessibility*, 1–3. https://doi.org/10.1145/3373625.3417079

17. Craven, S., Brown, S., & Gilchrist, E. (2006). Sexual grooming of children: Review of literature and theoretical considerations. *Journal of Sexual Aggression, 12*(3), 287–299. https://doi.org/10.1080/13552600601069414

18. de Vette, F., Dekker-van Weering, M., Tabak, M., & Vollenbroek-Hutten, M. (2016). Exploring personality and game preferences in the younger and older population: A pilot study. *Proceedings of the 9th International Conference on Health Informatics*, 99–106. https://doi.org/10.5220/0005790500990106

19. Digital Rights Foundation. (2022). *Online grooming in Pakistan*. https://digitalrightsfoundation.pk

20. Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*(6), 1087–1101. https://doi.org/10.1037/0022-3514.92.6.1087

21. Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. *International Journal of Educational Technology in Higher Education, 19*(1), 57. https://doi.org/10.1186/s41239-022-00362-6

22. Federal Investigation Agency (FIA) Cybercrime Wing. (2023). *Annual arrest reports*. Government of Pakistan.

23. Fotaris, P., Mastoras, T., & Lameras, P. (2023). Designing educational escape rooms with generative AI: A framework and ChatGPT prompt engineering guide. *Proceedings of the European Conference on Games-Based Learning*, 180–189. https://doi.org/10.34190/ecgbl.17.1.1870

24. Fryer, L. K., Ainley, M., Thompson, A., Gibson, A., & Sherlock, Z. (2017). Stimulating and sustaining interest in a language course: An experimental comparison of chatbot and human task partners. *Computers in Human Behavior, 75*, 461–468. https://doi.org/10.1016/j.chb.2017.05.045

25. Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming, 33*(4), 441–467. https://doi.org/10.1177/1046878102238607

26. Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment, 1*(1), 20. https://doi.org/10.1145/950566.950595

27. Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (2nd ed.). Palgrave Macmillan.

28. Granich, S., Jabeen, T., Omer, S., & Arshad, M. (2023). Addressing the issue of child sexual abuse in Pakistan: A conceptual analysis. *International Social Work, 66*(3), 715–725.

29. Habgood, M. P. J., & Ainsworth, S. E. (2007). Motivating children to learn effectively: Exploring the value of intrinsic integration in educational games. *Journal of the Learning Sciences, 20*(2), 169–206. https://doi.org/10.1080/10508406.2010.508029

30. Hamari, J., & Tuunanen, J. (2014). Player types: A meta-synthesis. *Transactions of the Digital Games Research Association, 1*(2). https://doi.org/10.26503/todigra.v1i2.13

31. Human Rights Watch. (2016). *No room to hide: Kasur's child abuse scandal*. https://www.hrw.org

32. Hwang, G.-J., & Chang, C.-Y. (2021). A review of opportunities and challenges of chatbots in education. *Interactive Learning Environments, 31*(7), 4099–4112. https://doi.org/10.1080/10494820.2021.1952615

33. International Labour Organization. (2022). *Case studies on child labor in Pakistan*. https://www.ilo.org

34. Journal of South Asian Studies. (2019). Media coverage and public discourse on the Zainab case. *Journal of South Asian Studies, 34*(2), 113–129.

35. Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. Pfeiffer.

36. Karam, R., Haidar, M. A., Khawaja, A., & Al Laziki, G. (2017). Effectiveness of subliminal messages and their influence on people's choices. *European Scientific Journal, 13*(17), 262–278.

37. Lancet Psychiatry. (2022). Mental health policy gaps for child abuse survivors in South Asia. *The Lancet Psychiatry, 9*(4), 275–277.

38. Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science, 5*(4), 333–369.

39. McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*(1), 81–90. https://doi.org/10.1037/0022-3514.52.1.81

40. Mushtaq, N., Nazeer, N., Fayaz, I., & Gulzar, F. (2025). Next-Gen learning: Gamification's impact on higher education. *Education and Information Technologies, 30*(1), 1–27.

41. Pakistan Pediatric Association. (2018). *Report on the psychological impacts of the Kasur abuse cases*.

42. Park, S., Min, K., & Kim, S. (2021). Differences in learning motivation among Bartle's player types and measures for the delivery of sustainable gameful experiences. *Sustainability, 13*(16), 9121.

43. Richter, K., & Kickmeier-Rust, M. (2025). Gamification in physics education: Play your way to better learning. *International Journal of Serious Games, 12*(1), 59–81.

44. Roberts, B. W., Chernyshenko, O. S., Stark, S., & Goldberg, L. R. (2005). The structure of conscientiousness: An empirical investigation based on seven major personality questionnaires. *Personnel Psychology, 58*(1), 103–139. https://doi.org/10.1111/j.1744-6570.2005.00301.x

45. Ronkainen, T. (2024). *Player types in a mobile game* (Master's thesis). University of Helsinki.

46. Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

47. Sahil. (2023). *Cruel numbers: Annual report on child sexual abuse in Pakistan*. https://sahil.org

48. Sanchez, A., Cannon-Bowers, J. A., & Bowers, C. (2011). Establishing a science of game-based learning. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 55*(1), 2009–2013. https://doi.org/10.1177/1071181311551418

49. Shah, S., Ahmed, T., & Malik, G. M. (2023). Understanding the prevalence of child abuse in Pakistan: A comprehensive study. *Pakistan Social Sciences Review, 7*(3), 72–86.

50. Shinogaya, T. (2012). Effects of learner-generated explanations on learning. *Japanese Psychological Research, 54*(3), 315–323. https://doi.org/10.1111/j.1468-5884.2012.00529.x

51. Shute, V., & Ventura, M. (2013). *Stealth assessment: Measuring and supporting learning in video games*. MIT Press. https://doi.org/10.7551/mitpress/9589.001.0001

52. Smutny, P., & Schreiberova, P. (2020). Chatbots for learning: A review of educational chatbots for Facebook Messenger. *Computers & Education, 151*, 103862. https://doi.org/10.1016/j.compedu.2020.103862

53. Society for the Protection of the Rights of the Child. (2023). *The state of Pakistan's children*. https://www.sparcpk.org

54. Tondello, G. F., Wehbe, R. R., Diamond, L., Busch, M., Marczewski, A., & Nacke, L. E. (2016). The Gamification User Types Hexad Scale. *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play*, 229–243. https://doi.org/10.1145/2967934.2968082

55. UNICEF. (2020). *Action to end child sexual abuse and exploitation: A review of the evidence 2020*.

56. UNICEF. (2023). *Pakistan country office annual report 2023*. https://www.unicef.org/media/152706/file/Pakistan-2023-COAR.pdf

57. UNICEF Pakistan. (2020). *Policy brief: Preventing child sexual abuse in Pakistan*. https://www.unicef.org/pakistan

58. Yee, N. (2006). Motivations for play in online games. *CyberPsychology & Behavior, 9*(6), 772–775. https://doi.org/10.1089/cpb.2006.9.772