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Article

Designing Gender-Sensitive Serious Games for Nutrition: Communication Innovations for Mothers, Children, and Brides-To-Be in Villages

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Abstract

Stunting continues to be a significant public health issue in Indonesia, with a countrywide frequency of 21.6% reported in 2022. Rural regions like Madura encounter exacerbated hazards stemming from cultural dietary prohibitions, gendered domestic dynamics, and restricted access to reliable health information. Mothers, young brides, and children are crucial to nutritional practices but frequently hindered by patriarchal standards and digital disparities. This study examines the efficacy of gender-sensitive serious games as novel communication instruments for nutrition education and stunting prevention in rural areas. The research used a qualitative exploratory design, incorporating over thirty respondents, including mothers of children under five, brides-to-be, cadres, midwives, community leaders, and social media influencers from various villages in Bangkalan, Madura. The data were evaluated topically, emphasizing gender roles, perceptions of artificial intelligence (AI), and prospects for digital health innovation. Research indicates that although mothers pursue advice and youth exhibit eagerness for digital tools, implementation necessitates endorsement from credible sources and cultural adjustment. Serious games, augmented with gamification and nudging techniques, were recognized as especially beneficial in promoting intergenerational learning, enhancing mother-child co-play, and empowering brides-to-be in pre-parenting scenarios. The research presents a framework that amalgamates feminist communication theory, health-oriented serious games, and technological acceptance paradigms. Essential design components are localized narratives, visual gamification indicators, offline functionality, and the incorporation of religious and cultural principles. Instead than supplanting conventional networks, serious games ought to augment the roles of cadres, midwives, and religious leaders within a hybrid communication framework. The results indicate that gender-sensitive serious games can connect traditional trust-based communication with digital innovation, providing a culturally relevant approach to expedite stunting reduction and promote equitable public health outcomes in rural Indonesia.

Keywords: serious games; gender-sensitive communication; nutritional education; stunting prevention; rural health innovation

1. Introduction

Stunting continues to be a significant public health issue in Indonesia and is acknowledged as a substantial obstacle to the attainment of the Sustainable Development Goals (SDGs). In 2022, the national prevalence of stunting was recorded at 21.6% (Kurniasari et al., 2022). Despite this indicating advancement relative to prior years, the figure remains above the worldwide benchmark established by the World Health Organization (WHO). In rural areas like Madura, the risk factors for stunting are exacerbated by cultural beliefs, patriarchal gender norms, food taboos, and ongoing digital gaps. Women, especially mothers and young brides, bear the principal responsibility for daily nutritional practices; nevertheless, their autonomy is sometimes restricted by limited control over home

resources and dependence on the counsel of elders. Comparable results have been documented in other resource-constrained environments, where systemic disparities hinder women's capacity to apply nutritional information successfully (Simbolon, 2024; Yunitasari, 2022). Emerging technologies, especially artificial intelligence (AI), are widely regarded as promising instruments for transforming health communication. AI-driven chatbots, gamified mobile applications, and digital nudges have demonstrated efficacy in enhancing food literacy and engagement through interactive and tailored teaching (Baranowski et al., 2019; Mitra et al., 2020). Serious games have effectively inspired behavioral modifications in nutrition and physical activity among children and adolescents (Limone, 2022; Liu, 2024). Global data underscores the issues of trust, contextualization, and inclusivity associated with the introduction of AI in rural or culturally conservative populations (Mechael, 2025).

This research tackles two significant deficiencies in both theoretical and practical domains. Initially, there has been insufficient investigation into gender-sensitive AI design for nutrition communication in resource-constrained rural environments. Secondly, current approaches seldom incorporate traditional trust-based communication networks such as health cadres, midwives, and religious leaders—with digital technologies. This study aims to illustrate how culturally relevant digital health tools, designed as gender-sensitive serious games for mothers, children, and brides-to-be, can enhance participatory nutrition education, mitigate stunting risks, and address communication disparities in underserved populations.

1.1. Theoretical Framework

This research is based on a gender-sensitive and participative theoretical framework that incorporates feminist communication theory, health-related serious games, gamification and nudging approaches, as well as the Technology Acceptance Model (TAM/UTAUT). Collectively, these viewpoints establish the conceptual framework for creating gender-sensitive serious games focused on nutrition, specifically targeting mothers, children, and brides-to-be in rural Madura.

1.2. Feminist Communication Theory

Feminist communication theory emphasizes that women serve as primary caregivers and decision-makers, but their authority is limited by patriarchal norms, intergenerational hierarchies, and socio-economic dependency (Meyers, 2014; Rakow & Wackwitz, 2004). In rural Indonesian households, moms are responsible for feeding children, whereas fathers and elders typically maintain control over resources and normative authority (Yunitasari, 2022). This asymmetry indicates that even knowledgeable mothers may not consistently act upon their understanding. Prospective brides are particularly susceptible, as early marriage diminishes their autonomy and restricts their access to reliable health information (Simbolon, 2024). Feminist theory posits that communication interventions must not merely convey knowledge but also redistribute agency and elevate marginalized voices (Byerly, 2018; Wajcman, 2020). This study conceptualizes serious games as instruments that legitimize women's lived experiences, empower them to confront taboos, and involve dads and elders in collaborative learning. By including cultural and religious values such as *halalan-thayyiban* these games can harmonize biomedical knowledge with cultural legitimacy (Lindsey, 2019).

1.2. Serious Games for Health and Nutrition

The second basis is serious games for health, which highlight the capacity of interactive digital play to alter behaviors. Serious games integrate teaching and enjoyment, offering quick feedback, simulations, and reinforcement mechanisms (Baranowski & Thompson, 2016; DeSmet, 2018). Research indicates that gamified interventions enhance food selections, physical activity, and illness management among various age demographics (Folkvord, 2021; Kato-Lin, 2020; Liu, 2024). Serious games can convert abstract nutrition guidelines into micro-learning experiences integrated into the daily routines of moms (Mitra et al., 2020). Gamified narratives featuring vibrant characters effectively promote healthy eating habits among youngsters by fostering positive associations with fruits, vegetables, and protein-rich foods (Ancona, 2024; Santa Cruz, 2024). For prospective brides,

games can function as pre-parenting simulations, allowing them to rehearse feeding choices, supplementing, and childcare situations in secure, private settings (Charlier, 2016).

Gamification techniques, including points, badges, leaderboards, and challenges, have demonstrated efficacy in maintaining motivation (Hamari, 2014). Nudging frameworks underscore the influence of minor cues such as reminders, stickers, or progress indicators in influencing daily decisions (Munson, 2016; Thaler & Sunstein, 2008). Collectively, these methodologies convert nutrition communication from a unilateral information dissemination into a participatory, memorable, and behaviorally impactful engagement.

1.3. Technology Acceptance Models (TAM/UTAUT)

The third pillar comprises the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Davis, 1989; Venkatesh & Davis, 2003). These models elucidate adoption through perceived usefulness, perceived ease of use, social influence, and facilitating factors. Mothers in rural Madura may find serious games beneficial, however they necessitate simplicity and cultural endorsement from trusted cadres like midwives. In contrast, children and adolescents are digital natives who engage with gamified platforms with enthusiasm (Ramadhani & Lestari, 2022). Religious leaders and community elders serve as significant social influencers: their support can expedite adoption, whilst their doubt may obstruct it. Creating serious games that correspond with these adoption dynamics via localized narratives, offline functionality, and religiously contextualized themes -promotes enhanced inclusivity.

1.4. Integrative Framework

Collectively, these ideas coalesce to inform the development of gender-sensitive serious games for nutrition: Feminist theory underscores the necessity of enhancing women's autonomy and confronting patriarchal limitations. Research on serious games illustrates that gamification, nudging, and interactive storytelling can enhance participation and facilitate behavioral change. Technology acceptance models elucidate how perceptions of utility, ease of use, and cultural validity influence adoption in rural contexts. This integrative framework establishes a foundation for innovations that are gender-responsive, culturally relevant, and technologically viable, ensuring that mothers, children, and brides-to-be in rural Madura are not merely recipients of information but active contributors to the development of healthier nutritional practices.

2. Methods

This study employed a qualitative exploratory methodology to elucidate the intricate interconnections of gender, culture, and communication about nutrition and stunting prevention in rural Madura. Data were gathered in June 2025 via various fieldwork operations carried out in villages within the Bangkalan district of Madura. The dataset included over thirty respondents embodying various community roles directly or indirectly associated with nutrition behaviors. The participants comprised mothers of children under five, who shared direct insights into daily feeding choices and the difficulties of reconciling contemporary health recommendations with cultural customs; young brides and grooms, whose experiences illustrated the impact of early marriage and restricted health literacy; and female health workers, who served as primary intermediaries between the healthcare system and the community. The research included village midwives, pivotal to maternal and child health services; male community leaders, who frequently wield authority in household and village decision-making; and social media managers, who shape the dissemination of information and narratives regarding nutrition and health in digital environments.

The diverse range of participants was deliberate, facilitating the triangulation of viewpoints across gender, age, and authority classifications. Mothers and brides discussed personal challenges regarding food taboos and decision-making authority, while cadres and midwives provided institutional and biomedical insights, and religious or community leaders emphasized normative and cultural impacts on home nutrition.

The methods of data gathering were semi-structured interviews, focus group discussions, and the observation of community health activities, including posyandu. Narratives were gathered on subjects such as everyday feeding patterns, dietary taboos, perceptions of nutritional guidance, and

receptiveness to digital health innovations. The data were subjected to thematic analysis. Inductive coding was employed to discern repeating patterns, subsequently categorized into themes including obstacles to nutritional practices, gendered decision-making, and prospects for digital innovation. Special emphasis was placed on participants' perceptions on the significance of serious games in enhancing nutrition communication, particularly when tailored to be gender-sensitive and culturally relevant.

3. Findings and Discussion

3.1. Contextual Background

The prevalence of child stunting in rural Madura illustrates a confluence of structural, cultural, and gendered elements that influence the perception and implementation of nutrition in daily life. Notwithstanding national initiatives and community health services, the incidence of stunting in children under five is markedly elevated in rural and neglected regions compared to urban areas. This study's qualitative data, derived from interviews with mothers, young brides, health professionals, midwives, and religious leaders, elucidates the reasons conventional communication strategies frequently fall short in addressing these challenges and underscores the urgent necessity for innovative approaches, such as gender-sensitive serious games.

Mothers in Madura villages often identified themselves as the principal caregivers for their children's nutrition. Their capacity to make informed feeding choices is hindered by inadequate health literacy, entrenched dietary taboos, financial difficulties, and the predominance of spouses or elders in household decision-making. One mother stated, "Occasionally, it is claimed that eggs induce fever, but the midwife asserted that this is merely a myth." "I experience confusion when the information provided by family members and healthcare professionals differs." (Mother ER, 25). This perplexity transcends mere access to knowledge and signifies conflicting powers within households. Alongside misinformation, early marriage exacerbates these vulnerabilities. Prospective brides and young mothers frequently lack the knowledge and confidence to execute appropriate feeding practices. A young bride stated, "I adhere to my mother-in-law's advice regarding nutrition during pregnancy." At times, I sense it is unjust, yet I hesitate to contest it" (Bride AN, 19). These stories elucidate the intergenerational and gendered dynamics that underlie nutritional behaviors.

Conventional health communication methods, such as posters at community health centers or lectures at integrated health posts, frequently fail to handle these issues effectively. Mothers participate in sessions; but, in the absence of interaction reinforcement at home, knowledge fails to result in enduring behavioral change. Health cadres noted that although women were receptive, they frequently forgot or reverted to traditional behaviors when returning home. One cadre stated, "We elucidate the principles of balanced nutrition; however, post-meeting, many continue to prepare food based on entrenched habits." Daily reminders are necessary for them" (Cadre PS, 40).

The disparity between information and behavior highlights the necessity for communication methods that are both informative and entertaining, interactive, and culturally relevant. Serious games offer a viable solution. Integrating nutrition education into play can strengthen daily habits, combat misinformation, and inspire behavioral change in a manner that appeals to women, children, and brides-to-be. Global evidence corroborates this methodology. Baranowski et al. (2016) discovered that serious games enhanced nutritional knowledge and habits in youngsters when tailored to cultural contexts. Folkvord et al. (2021) shown that gamification increased young children's vegetable intake by rendering healthy eating enjoyable. Ramadhani and Lestari (2022) emphasized the potential of gamified health treatments in rural Indonesian communities, while underscoring the necessity of community involvement in the design process. These findings indicate that serious games can connect abstract health recommendations with the actual experiences of individuals in rural Madura.

3.2. Mothers as Primary Users of Serious Games

Mothers are the primary target demographic for gender-sensitive serious games due to their pivotal role in child nutrition. Mothers are responsible for meal planning, determining food preparation, and feeding children several times daily. They are primarily held accountable for child malnutrition, hence intensifying the burden they endure. Consequently, creating serious games that assist and empower women is both rational and essential.

3.3. Daily Responsibilities and Overload

Mothers often articulated their substantial workload: managing childcare, domestic responsibilities, and occasionally income-producing tasks. In this environment, lengthy lectures or comprehensive pamphlets are unfeasible. Mothers require concise, captivating interventions that integrate effortlessly into their daily routines. According to one mother,

“I am busy from morning until night. If there is a game I can play for five minutes with my child, that is more useful than a long seminar” (Mother LS, 31).

Serious games intended for mothers should thus function as micro-learning instruments, providing brief lessons integrated inside gameplay rather than extended sessions. Visual stimuli, narratives, and interactive obstacles help distill intricate nutritional information into practical insights. For example, a game may feature a narrative in which a maternal character navigates a market, selecting between nutritious and detrimental food options, receiving timely feedback regarding the implications for her child’s development.

3.4. Conflicting Information and the Role of Games

A prevalent dissatisfaction among mothers was the contradictory advice received from several sources, including familial customs, social media, and healthcare professionals. A woman stated, “I frequently encounter guidance regarding infant nutrition on Facebook.” *Opinions on bananas vary; some assert they are detrimental, while others contend they are beneficial. “I am uncertain about whom to trust”* (Mother ZH, 29).

Serious games can tackle this difficulty by providing reliable, vetted information in captivating formats. In contrast to static banners or erratic social media posts, games can include explicit nutritional guidelines within narratives and objectives, so maintaining uniformity. Mothers indicated their faith in games sponsored by health professionals or midwives: “If the game originates from the puskesmas, I will have confidence in it.” “If it originates solely from the internet, perhaps not” (Mother ER, 25). This highlights the necessity of incorporating health authority certification into serious game design. Games ought to display the logos of health centers or personnel, and the personnel themselves should receive training to incorporate games into posyandu sessions, so enhancing confidence.

3.5. Visual Reminders and Gamified Nudges

Mothers also valued the concept of visual cues integrated into games. One stated, “Stickers of nutritious food in my kitchen serve as a daily reminder.” “If the game provides me with images like that, it will assist me” (Mother ZH, 29). The convergence of digital nudges and physical reminders is clearly apparent. Games can offer daily prompts-such as virtual stickers or reminders -that women can convert into tangible acts, such as affixing stickers in kitchens or on calendars.

Gamification elements, such as accruing points for preparing nutritious meals or receiving badges for fulfilling weekly objectives, could enhance motivation among mothers. These mechanisms correspond with moms’ aspiration for modest, attainable objectives. As one official noted, “Mothers are more excited when there are small rewards, even just recognition” (Cadre PS, 40).

3.6. Family Co-Play with Children

Several mothers envisioned playing games together with their children. One explained, “If my child plays a game about food and I play together, we both learn. It becomes fun, not just advice” (Mother ER, 25). This highlights the potential for serious games to serve as intergenerational tools, reinforcing lessons for both mother and child simultaneously.

Family co-play provides numerous advantages: it renders nutrition instruction fun, enhances parent-child relationships, and guarantees the reinforcement of teachings across both generations. International literature endorses this methodology: Baranowski et al. (2016) discovered that collaborative gameplay between parents and children resulted in more significant behavioral modifications than solitary play. For Madura mothers, co-play helps alleviate the feelings of isolation associated with independently managing nutritional obligations.

3.7. Rewards and Rural Realities

Mothers emphasized the motivational power of rewards. However, rewards must align with rural realities. A cadre explained, “Even simple gifts like cooking utensils make mothers excited to join” (Cadre PS, 40).

Consequently, serious games must provide not only digital rewards (such as badges and points) but also link to tangible offline incentives. For example, officials could provide little rewards to women who accomplish weekly goals in the game, establishing a hybrid offline–online incentive structure.

This methodology is endorsed by Self-Determination Theory (Kuntzleman & Johnson, 2020), which posits that extrinsic rewards can enhance intrinsic motivation when presented favorably. For Madura women, extrinsic rewards do not have to be costly; practical objects such as cooking utensils or public acknowledgment are adequate to boost motivation.

3.8. Religious Legitimacy for Mothers

For numerous women, confidence in nutritional guidance is bolstered when it aligns with religious doctrines. An ustadzah stated, “If the game educates us on consuming halal and nutritious food, it will facilitate acceptance among mothers” (Ustadzah NA, 42). Integrating Islamic concepts of moderation and halalan-thayyiban into gaming storylines can consequently improve acceptability.

For instance, a game might feature a narrative in which a mother instructs her child on the significance of consuming halal, nutritionally balanced meals, linking dietary practices to spiritual wellness. This integration enhances health and bolsters cultural legitimacy.

3.9. Children as Co-Players and Learners

A significant lesson derived from the data is the potential of serious games not just as instruments for mothers but also as intergenerational platforms that engage children as active participants. Mothers in Madura villages repeatedly noted that children derive pleasure from games and exhibit rapid learning when information is conveyed through entertaining, interactive methods. Serious games developed for nutrition can concurrently teach youngsters and enhance mother habits.

3.9.1. Learning Through Play

Children inherently acquire knowledge through play, and integrating nutrition education into interactive gaming formats enables children to assimilate good behaviors without recognizing them as formal “lessons.” A mother contemplated: “My child dislikes it when I instruct him to consume vegetables.” However, if there exists a game in which the character gains strength from consuming veggies, perhaps he will heed the advice” (Mother LS, 31). This comment emphasizes how games may convert abstract nutritional guidance into tangible, relevant storylines that engage children’s imagination.

This is corroborated by international literature. Folkvord et al. (2021) shown that exposure to gamified teaching tools enhanced children’s propensity to consume veggies. Kato-Lin et al. (2020) discovered that mobile games enhanced dietary selections among school-aged children by linking healthy eating with enjoyment and accomplishment. This study illustrates that children are not passive recipients of health education; rather, they are active learners capable of influencing family actions.

3.9.2. Intergenerational Co-Play

Mothers often underscored the importance of engaging in games with their children. A mother stated, “When my child engages in a food-related game and I participate, we both acquire knowledge.” It transforms into enjoyment, rather than mere counsel” (Mother ER, 25). Another remarked, “At times, my child pays more attention to the phone than to me.” “If the phone indicates that vegetables are beneficial, perhaps he will be persuaded” (Mother ZH, 29). These observations highlight the possibilities of family co-play as an innovative form of communication. Integrating nutrition instruction into games played by moms and children reinforces messages across generations. Mothers gain from prompts and affirmation, whilst children assimilate knowledge through interactive approaches. This twofold reinforcement alleviates the cognitive load on moms,

who frequently experience frustration when toddlers dismiss guidance. Researchers like Baranowski et al. (2016) contend that parent-child co-play markedly enhances knowledge retention and behavioral modification. In Madura, where moms often have challenges in persuading children to consume nutritious foods, serious games offer an innovative medium of influence—transforming the message into a humorous context, thus mitigating conflict.

3.9.3. Visual and Narrative Elements for Children

Creating serious games for children necessitates a focus on aesthetic appeal and narrative development. Informants indicated that youngsters favor vibrant characters, uncomplicated narratives, and prompt responses. A cadre observed: “Children in the village enjoy cartoons.” Characters such as animals or superheroes in the game will enhance player enjoyment” (Cadre PS, 40). Narratives may feature characters that become more robust or content as a result of consuming balanced meals, so implicitly associating nutrition with favorable results. A character may achieve greater success in quests subsequent to consuming veggies or seafood. This reflects findings from global studies indicating that youngsters react favorably to avatars or characters that exemplify healthy behaviors (Almeida et al., 2020).

3.9.4. Implications for Children

Children should not be regarded as secondary goals but as integral participants in serious games. By actively engaging children, games facilitate avenues for bottom-up influence, prompting children to remind parents of healthy choices. This phenomenon was noted in international research indicating that youngsters engaged in nutrition games motivated their families to purchase fruits and vegetables (Santa Cruz et al., 2024). In Madura, enabling children to serve as advocates for nutrition in their households could enhance the effectiveness of communication efforts.

3.10. Brides-to-Be and Young Women as Critical Targets

This study identifies brides-to-be and young women as another essential user group, representing the forthcoming generation of moms. Early marriage is common in Madura, and numerous young brides assume parenthood without sufficient nutritional information. Consequently, developing serious games for this group is crucial to avert intergenerational cycles of stunting.

3.10.1. Vulnerabilities of Brides-to-Be

Future brides frequently exhibit a deficiency in autonomy and confidence regarding nutritional choices. A 19-year-old bride confessed, “I merely adhere to my mother-in-law’s advice regarding nutrition during pregnancy.” At times, I sense it is unjust, yet I hesitate to contest it” (Bride AN, 19). This statement demonstrates how young brides manage contradictory expectations: adherence to elders with the necessity for proper health habits. Nutrition communication aimed at brides-to-be must consequently include both knowledge and empowerment. Serious games can fulfill this dual function by providing private, accessible learning spaces in which young women can cultivate confidence without the apprehension of judgment. In contrast to conventional classes where students may be reticent, games enable them to experiment, acquire knowledge, and make decisions inside virtual worlds.

3.10.2. Games as Pre-Parenting Tools

Serious games designed for brides-to-be can serve as pre-parenting simulations. A game might imitate pregnancy and childcare circumstances, incentivizing players for making good decisions, such as consuming iron supplements, cooking nutritious meals, or pursuing antenatal care. By engaging in a secure digital environment, young women can acquire information and skills prior to confronting real-world obligations. A bride proposed: “It would be beneficial to have a game that teaches me how to prepare meals for children, so that when I become a mother, I am already knowledgeable” (Bride AN, 19). This observation underscores the preventative capacity of serious games: by educating brides-to-be early, communities can mitigate the likelihood of inadequate feeding practices once children are born.

3.10.3. Digital Familiarity Among Youth

In contrast to older mothers, younger individuals exhibit greater digital literacy and proficiency with mobile applications. Engaged women often utilize social media, rendering them amenable to gamified digital interventions. A cadre observed: “Young women tend to engage with their phones frequently.” “If a nutrition game exists, they will attempt it” (Cadre PS, 40). This digital proficiency is an asset that can be utilized for health communication. Global evidence indicates that gamified mobile applications are particularly beneficial among youth populations (Liu et al., 2024). For rural Indonesian brides, games may amalgamate amusement with education, mitigating stigma and enhancing engagement.

3.10.4. Empowerment Through Serious Games

Significantly, serious games can enable brides-to-be to engage in negotiations with elders and spouses. By anchoring their knowledge in verified information, people can cultivate the confidence to promote healthy practices. A young bride stated, “If I possess a game that educates me about nutritious food, I can present it to my husband.” “Then he will also believe” (Bride AN, 19). This comment highlights how games can alter household dynamics by legitimizing the opinions of young women, thereby redistributing influence over nutritional decisions. This empowerment corresponds with feminist health communication ideas that emphasize the necessity of elevating underrepresented voices within patriarchal frameworks.

3.10.5. Consequences for Prospective Brides

For prospective brides, serious games should integrate enjoyment, education, and empowerment. Design features must incorporate private learning areas to mitigate shyness.

1. Simulations of gestation and childcare situations.
2. Gamified reinforcement of essential practices (iron supplementation, dietary diversification).
3. Integration of social sharing functionalities, allowing brides to demonstrate progress to husbands or peers, thereby enhancing legitimacy.

By focusing on brides-to-be, communication innovations can address a pivotal moment—prior to the establishment of detrimental eating practices—thus disrupting intergenerational cycles of malnutrition.

4.11. Key Design Elements of Gender-Sensitive Serious Games

The qualitative evidence from Madura highlights that the efficacy of serious games in nutrition education relies on technological functioning, cultural resonance, gender sensitivity, and contextual relevance. The subsequent subsections consolidate essential design features derived from interviews and focus groups, incorporating insights from global literature.

4.11.1. Localized Storylines

Participants often underscored the necessity of integrating nutrition messaging inside familiar storylines. A representative stated: “If the narrative in the game revolves around a mother in the village who prepares meals for her child, mothers here will perceive it as their own narrative.” “If the game pertains to a city mother, it will be described as distinct” (Cadre PS, 40). Mothers and brides-to-be reiterated this, emphasizing the significance of related circumstances.

Localized narratives may encompass scenarios such as preparing meals for children prior to school, buying in conventional markets, or negotiating with elders regarding food taboos. Utilizing characters that embody rural life—such as agriculturists, market sellers, or spiritual educators—games can ground nutrition education in quotidian realities. International studies corroborate this. Almeida et al. (2020) demonstrated that culturally customized games elicited more significant behavioral modifications than generic designs.

4.11.2. Visual Gamified Cues

Visuals are crucial for engagement, especially among mothers with restricted literacy. A mother stated, “Stickers depicting healthy food in my kitchen serve as a daily reminder.” “If the game provides me with images like that, it will assist me” (Mother ZH, 29). Visual gamified indicators may manifest as icons, animations, or progress bars that symbolize nutritional selections. A youngster avatar may exhibit increased height or a more radiant smile when healthier meal options are chosen.

These visual indicators convert abstract health recommendations into tangible feedback mechanisms. Folkvord et al. (2021) found that visual reinforcement in games markedly enhanced vegetable intake in youngsters. In Madura, such cues may mitigate inadequate textual literacy, ensuring that messages remain accessible to all users.

4.11.3. Mother–Child Gameplay

Family co-play has emerged as a highly promising design idea. Mothers articulated that engaging in play with their children might diminish resistance and render nutrition teaching fun. “When my child engages in a food-related game and I participate, we both acquire knowledge.” It transforms into enjoyment, rather than mere counsel” (Mother ER, 25).

Mother-child co-play enhances intergenerational learning and alleviates the stress mothers experience when children dismiss guidance. Games facilitating dual participation, such as a mother assisting in cooking while a youngster selects ingredients, could replicate authentic teamwork in meal preparation. Baranowski et al. (2016) discovered that parent–child co-play resulted in more significant and enduring behavioral modifications compared to solitary play.

4.11.4. Rewards Aligned with Rural Practices

Rewards constitute an essential motivational element. Informants emphasized that both digital and tangible rewards were successful, provided they correspond with rural realities. A cadre observed: “Even modest gifts such as cooking utensils elicit enthusiasm among mothers to participate.” Incentives are highly effective in villages” (Cadre PS, 40).

Digital awards may encompass badges, stars, or certificates, whereas offline incentives could consist of food coupons, culinary gear, or public acknowledgment at posyandu. This hybrid system recognizes that although digital validation is encouraging, physical goods continue to be greatly esteemed in resource-constrained communities. Self-Determination Theory (Ryan & Deci, 2000) posits that when extrinsic rewards are significant and culturally relevant, they enhance intrinsic drive instead of diminishing it.

Integration of Religious and Cultural Principles

The emergence of religious legitimacy became a prevalent theme. An ustadzah stated: “If the game educates us on consuming halal and nutritious food, it will be more readily accepted by mothers” (Ustadzah NA, 42). Integrating Islamic concepts of halalan-thayyiban (permissible and healthful eating), moderation, and thankfulness can enhance credibility and acceptability.

Games could, for instance, incorporate narratives in which characters utter short prayers prior to meals or highlight the virtue of providing children with nutritious nourishment as a form of reverence. Global research indicates that games tailored to cultural and religious contexts attain more acceptance (Santa Cruz et al., 2024). For Madura groups, adherence to Islamic beliefs may be the pivotal factor in acceptance.

4.11.5. Simplicity and Offline Compatibility

Mothers and officials underscored the necessity for simplicity. Numerous households possess restricted internet connectivity, and certain mothers utilize basic smartphones. A mother said, “I do not fully comprehend intricate applications.” “If the game is uncomplicated, featuring images and straightforward buttons, I can attempt it” (Mother LS, 31).

Consequently, games should be lightweight, available without internet connectivity, and optimized for low-end devices. This technical simplicity is not a constraint but an opportunity: by minimizing complexity, the games may enhance reach and inclusivity.

4.12. Implications for Communication Innovations

The aforementioned design features have significant consequences for health communication, especially in rural settings where conventional methods have proven inadequate.

4.12.1. From Information Delivery to Interactive Engagement

Conventional communication methods frequently depend on one-way dissemination—such as lectures, posters, or written materials. Although instructive, these strategies do not ensure memory or behavioral modification. In contrast, serious games convert learning into direct participation. They integrate nutrition instruction into daily activities through play, rendering it memorable and actionable.

This transition reflects a wider global trend towards participatory and interactive health communication. Baranowski et al. (2019) contend that games function not merely as delivery mechanisms but as engines for behavioral modification, capable of transforming routines through reinforcement and motivation.

4.12.2. Addressing Gendered Barriers

Gender-sensitive game design directly confronts the obstacles encountered by moms and brides. By including mother-child co-play, games alleviate the isolation women experience in managing nutrition. Through the provision of private, empowering educational environments, games furnish brides-to-be with the information and confidence necessary to confront taboos and engage in negotiations with elders. Incorporating dads and elders into narratives fosters a sense of collective responsibility within games. These tactics correspond with feminist health communication concepts, which advocate for a transition from individual culpability to collective accountability. Their findings corroborate those of Simbolon et al. (2024), which shown that adolescent marriage markedly elevates the likelihood of stunting—a challenge that can be alleviated with early, empowering education for brides.

4.12.3. Bridging Digital Divides

A primary danger of digital health treatments is exclusion resulting from digital divides. Nevertheless, serious games tailored for low-end devices and endorsed by frameworks can close this divide. By integrating online and offline components, they guarantee that women with restricted literacy or connectivity can engage. For instance, cadres could organize group play sessions during posyandu, promoting inclusivity. This hybrid paradigm acknowledges that although AI and digital tools present benefits, they must be integrated into community frameworks to attain equity.

4.12.4. Building Trust Through Validation

Trust is fundamental in rural Madura. Mothers consistently emphasized that their faith in a game would be contingent upon its origin from the puskesmas or cadres. This underscores the necessity for validation and co-branding. Games ought to be perceived not as external commodities but as community-owned instruments, approved by reputable health authorities and religious figures.

Globally, trust has been recognized as a crucial factor influencing the adoption of digital health (WHO, 2023). In Madura, integrating serious games within community networks guarantees their perception as locally rooted inventions rather than external impositions.

4.12.5. Policy and Scale-Up Implications

The results have considerable ramifications for policies aimed at preventing stunting. Initially, serious games ought to be incorporated into current government initiatives, such as BKKBN's family planning and nutrition campaigns. Secondly, collaborations with local health professionals, non-governmental organizations, and religious entities are essential for establishing credibility. Third, evaluation frameworks must be established to assess not only information acquisition but also behavioral modifications and stunting results. Nationally scaling serious games could revolutionize Indonesia's stunting prevention strategy. This necessitates investment in localized content

development, capacity enhancement for personnel, and stringent oversight. The WHO (2024) underscores that digital health initiatives should be expanded with a focus on equity and gender sensitivity.

5. Conclusions

This project aimed to investigate the creation of gender-sensitive serious games as creative communication tools for nutrition education and stunting prevention in rural Indonesia, namely in Madura. This research underscores the critical necessity for communication treatments that are informative, interactive, culturally relevant, and responsive to gender, by integrating insights from feminist communication theory, health-focused serious games, and technology acceptance models.

5.1. Summary of Findings

The results indicate that mothers are pivotal in infant nutrition; nevertheless, their authority is restricted by patriarchal norms, limited control over household finances, and the influence of mothers-in-law or elders who uphold traditional food taboos. Young brides, frequently wed at a tender age, embark on parenthood lacking adequate education or confidence, hence continuing intergenerational cycles of starvation. Children are both recipients and engaged learners who react favorably to participatory and playful methods of nutrition teaching. Simultaneously, developing digital technologies—such as AI-driven chatbots, gamified applications, and digital nudges—offer opportunity to provide tailored, accessible, and engaging nutrition information. Adoption is influenced by trust, ease of use, and endorsement from community leaders, including health workers, midwives, and religious authorities. These interactions highlight the necessity of creating meaningful games that are attuned to local situations and encompass all stakeholders in the nutrition ecosystem.

5.2. Theoretical Contributions

The study contributes theoretically in three distinct ways. First, by applying feminist communication theory, it emphasizes that interventions must go beyond providing knowledge to women; they must also tackle the structural inequities that limit women's ability to act on that knowledge. The incorporation of serious games research illustrates that gamification and nudging techniques can connect abstract health messages with daily behaviors, generating micro-learning chances that align with the routines of mothers and children. Third, via the framework of technology acceptance models (TAM/UTAUT), the study indicates that adoption in rural settings is contingent not only upon perceived utility and user-friendliness but also on cultural legitimacy and confidence in conventional communication networks.

5.3. Practical Implications for Design

The research presents multiple fundamental design concepts for gender-sensitive serious games:

1. Contextual tales that depict rural existence, encompassing markets, domestic settings, and communal traditions, enabling mothers and prospective brides to identify with the stories.
2. Visual gamified indicators to assist users with inadequate literacy, guaranteeing that nutrition messages are comprehensible to everyone.
3. Mechanisms of mother-child co-play that promote intergenerational learning and enhance familial connections around healthy eating. Reward systems that integrate digital badges with physical incentives, such as cooking equipment or acknowledgment at posyandu, to maintain motivation.
4. Incorporation of religious and cultural values, including halalan-thayyiban principles, to improve acceptance among mothers, elders, and community leaders.
5. Offline compatibility and simplicity, guaranteeing that games remain functional on low-end devices and in regions with restricted connectivity.

These design implications guarantee that serious games are not isolated but integrated within the wider cultural and technological framework of rural Madura.

5.4. Policy Implications

The study indicates that serious games can function as scalable innovations in Indonesia's national efforts for reducing stunting, according to policymakers. By integrating serious games into established programs-such as BKKBN's family planning initiatives and the Ministry of Health's nutrition campaigns-governments may augment outreach and participation. Collaborations with local NGOs, health professionals, and religious institutions are crucial for ensuring legitimacy and sustainability. Additionally, assessment frameworks must be established to quantify not only knowledge acquisition but also enduring behavioral modifications and long-term decreases in stunting rates.

5.5. Limitations and Future Research

The study offers significant insights, however it possesses limitations. The qualitative characteristics of the data, derived from five field reports in Madura, constrain generalizability. Future research ought to use mixed-methods approaches, integrating randomized controlled trials of serious games with anthropological investigations of home dynamics. Moreover, additional investigation is required to ascertain how AI-driven customisation can be reconciled with data privacy and ethical considerations, particularly concerning vulnerable populations like as children and young brides. Cross-regional comparisons within Indonesia and Southeast Asia may elucidate how cultural differences influence the reception of serious games.

5.6. Final Reflection

Ultimately, the study emphasizes that creating gender-sensitive serious games transcends mere technology innovation. The technique involves recontextualizing health communication to be participative, empowering, and culturally integrated. By providing moms, children, and brides-to-be with resources that align with their lived experiences, serious games can convert passive health guidance into engaging learning opportunities. When integrated with the trust and authority of cadres, midwives, and religious leaders, these games has the capacity to engender enduring changes in nutritional practices and alleviate the incidence of stunting in rural communities.

In conclusion, gender-sensitive serious games signify a hopeful advancement in public health communication. They connect conventional trust-based networks with contemporary digital tools, guaranteeing that marginalized communities are not excluded from the digital health transformation. For Indonesia, investing in culturally relevant technologies may be essential for attaining its stunting reduction objectives and fostering healthier futures for subsequent generations.

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Informed Consent Statement: Verbal informed consent was obtained from all participants involved in the study prior to interviews and focus group discussions. All participants were clearly informed about the study objectives, voluntary participation, and the confidentiality of their personal data. No personal identifiers (names, photographs, or addresses) were collected or published in this research.

Data Availability Statement: The qualitative datasets generated and analyzed during the current study are not publicly available due to confidentiality agreements with participants but are available from the corresponding author upon reasonable request.

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