

Gamified Teaching Design and Practice for the Elderly within the Framework of Proactive Health

Zixian Huang^a, Boya Ding^b, Xinran Yuan^c

School of Journalism and Communication, Hunan Normal University, Changsha, Hunan Province, (410000), China

^a 1770284724@qq.com, ^b 1357801809@qq.com, ^c yxr2820608151@qq.com

Abstract: This paper adopts the DMC pyramid model as the theoretical foundation for gamification design. By considering the gaming capabilities of the elderly, a coherent game logic is developed. This logic serves as the basis for designing or adapting physical games tailored to the elderly, integrating health knowledge into the game content. The games are interconnected through a reward system, culminating in a comprehensive and actionable community health communication activity. This approach outlines a gamification-based pathway for elder-friendly health communication, ultimately enhancing health literacy and promoting proactive health among the elderly.

Keywords: Proactive Health; Gamified Design; DMC Pyramid Model.

1. Introduction

In the face of the surging wave of an aging population, China confronts the dual challenges of a large absolute number of elderly individuals and the rapid acceleration of aging (Naik et al., 2008). This demographic shift exacerbates societal burdens, as issues such as "survival with illness" and "unhealthy longevity" become increasingly prevalent among the elderly. Furthermore, the low health literacy among older adults and the suboptimal effectiveness of current health communication strategies demand urgent solutions (King et al., 2013). Given this context, this paper employs a comprehensive methodology, including literature review, in-depth interviews, and data analysis, to address these pressing issues (Liu et al., 2020). The community, characterized by its geographical accessibility and psychological proximity, is identified as the primary platform for health communication targeted at the elderly. Leveraging the DMC (Design, Modify, Create) model, this study proposes the adaptation of games to suit the needs of older adults, thereby introducing innovative, gamified design strategies. This approach aims to enhance the efficacy of health communication, ultimately improving health literacy among the elderly population. By reimagining health communication through the lens of gamification, this research endeavors to transform the traditional paradigms, offering a more engaging and effective means to elevate the health awareness and practices of older adults (Steger et al., 2015).

2. Related Concept

2.1. Proactive Health

"Proactive Health" encompasses the entirety of social activities centered around creating value for life and health. This concept includes controlling health risk factors from the source of all social activities, generating health value throughout the process, and actively addressing population safety crises at every stage of these activities (Timpka, 2001). As public awareness and literacy regarding health have improved and consumption levels have risen, medical needs are no longer the primary concern of the populace. In today's societal context, the elderly require a new integrated and

continuous healthcare service model (Steger et al., 2015). This model spans the entire life cycle and health spectrum, combining non-pharmacological and pharmacological interventions, such as healthy diet, exercise, physical and mental well-being, environmental and cultural factors, and incorporating prevention, diagnosis, treatment, rehabilitation, care, and wellness services into one cohesive system (Naik et al., 2008). Beginning in 2018, the National Key Research and Development Program initiated a major project on "Proactive Health and Aging Technology Response," focusing on a strategic shift to a "health-centered" approach and the strategic needs of "healthy aging," thus laying a solid foundation for achieving the goals of Healthy China 2030 (Timpka, 2001).

3. The DMC Model

In "Gamification Thinking," Kevin Werbach integrates 30 game elements into a three-layer pyramid structure based on their level of abstraction: Dynamics, Mechanics, and Components. The DMC model's categorization of game elements allows projects to select and freely combine relevant game elements based on the actual conditions of the community and the elderly population (Yongjun & Jianya, 2003). This enables the unique advantages of each game element to be utilized, ultimately devising a specific gamified design for health communication targeted at the elderly in the community, making health content more engaging and enhancing its dissemination effectiveness (Naik et al., 2008).

4. Analysis of Gamified Health Communication Pathways

Before embarking on gamified design, it is crucial to clarify the main content and objectives of the game activities, which will serve as the foundation for the game design. This study selects "guiding reasonable dietary habits" as the primary content and goal of the game design, as proposed in the "Healthy China 2030" Planning Outline's initiative to foster autonomous and disciplined health behaviors (Hakim et al., 2024). Guiding reasonable dietary habits involves widespread dissemination of dietary nutrition knowledge, encouraging residents to form scientific dietary habits, and promoting the

construction of a healthy eating culture (Lister et al., 2014). The elderly, as a key demographic, often have various poor dietary habits, such as frequently consuming pickled foods and improperly stored leftovers, excessively adding salt, soy sauce, and sugar while cooking, and overindulging in alcohol (Yongjun & Jianya, 2003). These unhealthy habits not only increase the risk of digestive system diseases but also induce hypertension and elevate the risk of serious illnesses among the elderly (Ouyang et al., 2022). By employing the DMC model to design and apply gamification in health communication, elderly participants can learn correct dietary nutrition knowledge through gameplay, rectify poor eating habits, and develop proper dietary practices. This approach aims to improve their health literacy and achieve the goal of proactive health (Uechi et al., 2018).

5. Clarifying Activity Objectives

Effective gamification design necessitates clear activity objectives. The primary goal of this gamified design is to encourage elderly individuals to develop healthy dietary habits (Johnson et al., 2016). This objective has two main levels: Game designers need to gain a comprehensive understanding of dietary knowledge (King et al., 2013). Using "audience segmentation theory" as a foundation, they should select information appropriate for the health literacy and learning capabilities of the elderly. Second, the chosen dietary knowledge elements should be seamlessly integrated into the game design. By incorporating a points reward system, team collaboration, and diverse game tasks, the design aims to enhance the interactive experience for elderly participants, stimulate their enthusiasm for learning, and reinforce their acquired knowledge through repeated game participation, thereby improving the effectiveness of health communication (Lister et al., 2014).

6. Developing Health Communication Activity Flow Including Games

This step, based on the DMC model, utilizes its three elements: Dynamics, Mechanics, and Components (Liu et al., 2020). The Dynamics element directs the overall motivational drive, stimulating the intrinsic motivation of the elderly to engage in the game, making gamified health communication more appealing than traditional methods. The mechanics element forms the driving framework, providing clear guidance for the elderly to navigate through the game (Hlaing et al., 2024). The Components element materializes the driving framework, effectively stimulating and sustaining the elderly's enthusiasm throughout the entire gaming activity. Based on the DMC pyramid model, the following health communication activity flow incorporating games can be established: Dietary Knowledge Explanation → Game → Points → Prize Redemption → Effectiveness Evaluation (Hakim et al., 2024).

The sequence of Dietary Knowledge Explanation → Game can be adjusted according to specific conditions of the activity venue, time, and number of participants. For example, it could follow the pattern of Dietary Knowledge Explanation → Game N → Points → Dietary Knowledge Explanation → Game N+1 → Points, or Dietary Knowledge Explanation → Game N + Game N+1 + Game N+2... → Points (Ouyang et al., 2022).

7. Designing Elderly-Friendly Games Based on the DMC Model

By combining the DMC model with dietary knowledge, games can be structured and adapted for the elderly, considering Dynamics, Mechanics, and Components layers, and utilizing audience segmentation theory to create original games for health communication targeted at the elderly population (Yongjun & Jianya, 2003):

True or False Identification: Place healthy and unhealthy food items in a group for the game. When the staff names a healthy food item, participants clap twice; for an unhealthy item, they stomp twice. Each round involves 5-8 participants, with six questions per round, over three rounds, each lasting 60 seconds. The participant with the highest accuracy scores points.

Smart Ball Toss: Divide all participating elderly individuals into two teams, lining up to toss balls. Each participant throws a ball into a bucket labeled "healthy" or "unhealthy" based on the food brand named by the staff. Each participant gets three throws within a three-minute time frame. The team with the most correct throws wins, and each member receives a points card (Ouyang et al., 2022).

Quick-Wit Ribbon Grab: Categorize different foods into three nutrient groups: fats, carbohydrates, and dietary fibers, and write the names of the foods on ribbons. At the start of the game, participants must quickly grab the ribbon corresponding to the nutrient type mentioned by the volunteer. The first participant to grab the correct ribbon each time receives a points card. The game ends when only one ribbon remains (Alahäivälä & Oinas-Kukkonen, 2016).

These games not only enrich the content of health communication but also significantly enhance its effectiveness. By leveraging the motivation to win and positive team collaboration, the elderly can overcome their reluctance to engage deeply with seemingly dry and tedious dietary knowledge, making the learning process more enjoyable and impactful (Ouyang et al., 2022).

8. Conclusion and Discussion

The elderly, as a digitally disadvantaged group, encounter numerous obstacles in accessing timely and authoritative health information. These challenges stem from various factors such as the natural decline in physical capabilities, the widespread presence of misleading health information, and the busy lives of their children who might otherwise assist them (Roy & Biswas, 2023). As a result, the elderly often find it difficult to obtain the accurate and reliable health information necessary for maintaining their well-being (Pavel et al., 2015). Innovative approaches are essential to address these challenges effectively. One promising strategy is the use of gamification in health information dissemination. By integrating game design elements into health education, we can transform both the content and the methods of health communication (Roy & Biswas, 2023). This approach not only makes the dissemination of health information more engaging and enjoyable but also significantly enhances its effectiveness. Gamification offers a dynamic way to convey health messages (Pereira et al., 2014). Through carefully designed games, elderly individuals can engage in interactive activities that promote learning and retention of important health information. For instance, games that involve identifying healthy and unhealthy foods, participating in team-based health challenges, and competing in knowledge-

based activities can make the learning process more appealing and memorable (Asthana et al., 2017). These games can also be tailored to the cognitive and physical abilities of the elderly, ensuring that they are accessible and enjoyable for all participants. Furthermore, gamification can foster a sense of community and social interaction among the elderly. By participating in group activities and team-based games, they can build social connections and support networks, which are crucial for mental and emotional well-being. This social aspect of gamification not only makes the learning process more enjoyable but also helps to combat the isolation and loneliness that many elderly individuals face (Lotter et al., 2020).

Through the use of points systems, rewards, and progress tracking, gamification can motivate the elderly to engage more consistently with health education activities. The intrinsic motivation to win and the extrinsic rewards of points and prizes can drive sustained participation and interest in health topics. This continuous engagement is key to reinforcing healthy behaviors and ensuring that the knowledge gained is applied in daily life. Moreover, gamification provides a practical platform for the elderly to practice health-related behaviors in a safe and supportive environment (Lotter et al., 2020). For example, games that simulate meal planning, exercise routines, or medication management can help elderly individuals develop and reinforce these important skills. By practicing these behaviors in a game setting, they can gain confidence and competence, which can translate into better health outcomes in real life (Pavel et al., 2015).

In conclusion, the application of gamification in health information dissemination represents a significant advancement in addressing the unique challenges faced by the elderly (Zhang et al., 2006). By making health education more engaging, interactive, and socially connected, gamification enhances the effectiveness of health communication and helps to improve the health literacy of the elderly population. As we continue to innovate in this field, it is crucial to tailor these approaches to the specific needs and capabilities of the elderly, ensuring that they can benefit fully from these advancements. Ultimately, gamification has the potential to empower the elderly to take control of their health, leading to improved quality of life and better health outcomes (Asthana et al., 2017).

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References

- [1] Alahäivälä, T., & Oinas-Kukkonen, H. (2016). Understanding persuasion contexts in health gamification: A systematic analysis of gamified health behavior change support systems literature. *International journal of medical informatics*, 96, 62-70.
- [2] Asthana, S., Megahed, A., & Strong, R. (2017, June). A recommendation system for proactive health monitoring using IoT and wearable technologies. In *2017 IEEE international conference on AI & mobile services (AIMS)* (pp. 14-21). IEEE.
- [3] Hakim, H., Driedger, S. M., Gagnon, D., Chevrier, J., Roch, G., Dubé, E., & Witteman, H. O. (2024). Digital Gamification Tools to Enhance Vaccine Uptake: Scoping Review. *JMIR Serious Games*, 12(1), e47257.
- [4] Hlaing, P. H., Cheah, P. Y., & Boonchutima, S. (2024). Ethical gamified health communication intervention to prevent Work-related Musculoskeletal Disorders (WMSDs) in Myanmar migrants at Thailand's seafood factory: A study protocol. *Wellcome Open Research*, 9, 347.
- [5] Johnson, D., Deterding, S., Kuhn, K. A., Staneva, A., Stoyanov, S., & Hides, L. (2016). Gamification for health and wellbeing: A systematic review of the literature. *Internet interventions*, 6, 89-106.
- [6] King, D., Greaves, F., Exeter, C., & Darzi, A. (2013). 'Gamification': Influencing health behaviours with games. *Journal of the Royal Society of Medicine*, 106(3), 76-78.
- [7] Liu, H. C., Zhang, L. J., Ping, Y. J., & Wang, L. (2020). Failure mode and effects analysis for proactive healthcare risk evaluation: a systematic literature review. *Journal of evaluation in clinical practice*, 26(4), 1320-1337.
- [8] Lister, C., West, J. H., Cannon, B., Sax, T., & Brodegard, D. (2014). Just a fad? Gamification in health and fitness apps. *JMIR serious games*, 2(2), e3413.
- [9] Lotter, S., Ahmadzadeh, A., & Schober, R. (2020). Synaptic channel modeling for DMC: Neurotransmitter uptake and spillover in the tripartite synapse. *IEEE Transactions on Communications*, 69(3), 1462-1479.
- [10] Naik, A. D., Kallen, M. A., Walder, A., & Street Jr, R. L. (2008). Improving hypertension control in diabetes mellitus: the effects of collaborative and proactive health communication. *Circulation*, 117(11), 1361-1368.
- [11] Ouyang, P., Wang, J. J., & Ali, U. (2022). The impact of gamification on the patient's engagement in the online health community. *Aslib Journal of Information Management*, 74(6), 1196-1213.
- [12] Pavel, M., Jimison, H. B., Korhonen, I., Gordon, C. M., & Saranummi, N. (2015). Behavioral informatics and computational modeling in support of proactive health management and care. *IEEE Transactions on Biomedical Engineering*, 62(12), 2763-2775.
- [13] Pereira, P., Duarte, E., Rebelo, F., & Noriega, P. (2014). A review of gamification for health-related contexts. In *Design, User Experience, and Usability. User Experience Design for Diverse Interaction Platforms and Environments: Third International Conference, DUXU 2014, Held as Part of HCI International 2014, Heraklion, Crete, Greece, June 22-27, 2014, Proceedings, Part II 3* (pp. 742-753). Springer International Publishing.
- [14] Roy, D., & Biswas, U. N. (2023, August). They Need to Know and Learn—Gamified Social Communication Framework for Adolescent Reproductive Health and Well Being. In *IFIP Conference on Human-Computer Interaction* (pp. 563-568). Cham: Springer Nature Switzerland.
- [15] Steger, M. F., Fitch-Martin, A. R., Donnelly, J., & Rickard, K. M. (2015). Meaning in life and health: Proactive health orientation links meaning in life to health variables among American undergraduates. *Journal of Happiness Studies*, 16, 583-597.
- [16] Timpka, T. (2001). Proactive health computing. *Artificial Intelligence in Medicine*, 23(1), 13-24.
- [17] Uechi, H., Tan, N., & Honda, Y. (2018). Effects of gamification-based intervention for promoting health behaviors. *The Journal of Physical Fitness and Sports Medicine*, 7(3), 185-192.
- [18] Yongjun, W., & Jianya, G. (2003). A COM-based framework for management, analysis and visualization of large scope digital elevation models. *Geo-spatial Information Science*, 6(3), 32-36.
- [19] Zhang, L., Aksakal-Kocaman, S., Akca, D., Kornus, W., & Baltasvias, E. P. (2006). Tests and performance evaluation of DMC images and new methods for their processing. *ISPRS Archives*, 36.