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An AI Anti-Fraud Physical Card Game Design for Older Adults

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Abstract

With the rapid development of AI-generated image technologies, the use of AI-synthesized fake images to commit fraud against older adults is increasing. This study aims to design and preliminarily validate a physical card game for older adults to support the identification of typical flaws in AI-generated images, enhance anti-fraud capabilities, and promote family intergenerational interaction and cultural identity. Based on the cognitive characteristics and learning preferences of older adults, this research constructs a game design model integrating task-driven learning, immediate feedback mechanisms, and emotionally supportive companionship scenarios. First, through literature analysis and expert interviews, AI image recognition knowledge suitable for older adults was extracted and transformed into game tasks and interactive content. Subsequently, a physical card game prototype named "True Sight" was developed, comprising three modules: image cards, feature prompt cards, and special function cards, covering 12 types of recognition features including fingers, ears, text, shadows, teeth, texture, season, era, background, repetition, common sense, and lighting. Finally, a preliminary evaluation of the prototype was conducted through playtesting with older adults and brief interviews. The results indicate that task-driven recognition exercises, immediate feedback mechanisms, and intergenerational cooperation scenarios can enhance older adults' learning interest, help them understand AI flaw characteristics, and improve the

perceived effectiveness of anti-fraud knowledge. This study provides a design framework for transforming anti-fraud knowledge into an older adult-centered educational gaming experience and offers practical references for the application of educational games in anti-fraud education for older adults.

Keywords: Older adult education; AI anti-fraud; physical card game; intergenerational interaction; gamified learning

1. Introduction

Against the backdrop of rapid artificial intelligence development, the fidelity of generative AI images has reached a level that is nearly indistinguishable to the naked eye. While this technological advancement promotes the growth of creative industries, it is also maliciously exploited by criminals to create fake prize notifications, forged images of relatives seeking help, and synthetic endorsements by authoritative figures, specifically targeting older adults for precise fraud. In recent years, public awareness of anti-fraud has continued to increase, with public security agencies and platforms strengthening enforcement. However, fraudulent tactics have simultaneously evolved, transitioning from traditional telecom fraud to compound fraud integrating AI face-swapping, voice cloning, and deepfakes, resulting in significantly improved concealment and success rates. Due to reduced information processing speed, diminished visual discrimination ability, and unfamiliarity with new technologies, older adults have become a vulnerable group to such fraud.

Concurrently, the population of older adult internet users in China continues to expand. The proportion of internet users aged 50 and above has increased from 26.3% in 2020 to 32.5% in 2023, with older adults increasingly becoming important participants in digital life. However, existing anti-fraud education research and practices for older adults still have significant shortcomings: traditional formats primarily include community lectures, flyers, and news alerts, characterized by fragmented content and a lack of interactive feedback, making it difficult to achieve effective knowledge-to-behavior transformation; digital educational resources often deter older adults due to complex interfaces and high operational barriers; more importantly, most studies fail to effectively integrate anti-fraud education with older adults' family support networks, overlooking the unique value of intergenerational interaction in reducing loneliness, enhancing emotional trust, and facilitating knowledge transfer.

Gamified education offers new possibilities for addressing these issues. Educational games, through goal setting, immediate feedback, role interaction, and contextual narratives, embed learning content into low-pressure, repeatable practice experiences. Research shows that gamified interventions can reduce older adults' cognitive load, leverage their rich life experience advantages, and combine judgment tasks with contextual reasoning. Moreover, intergenerational cooperation models allow older adults to feel valued and accompanied when playing games with their children or grandchildren, thereby enhancing learning motivation and persistence.

Based on this background, this study identifies the core problem in current AI anti-fraud education for older adults as "primarily knowledge-based instruction with insufficient interactivity and family integration," failing to meet older adults' cognitive characteristics and emotional needs. To this end, this study designed and developed a physical card game called "True Sight." Through literature analysis and expert interviews, 12 types of typical AI image flaw features were extracted and transformed into actionable game tasks and interaction mechanisms. A card system comprising image cards, feature prompt cards, and special function cards was constructed, supporting both individual practice and family intergenerational cooperation modes. This study aims to answer the following questions: Which AI image flaw features are suitable for older adults to identify? How can these features be transformed into understandable, repeatable card tasks with immediate feedback? Does this game prototype have the potential to enhance learning interest and anti-fraud cognition?

This study not only provides an actionable gamified solution for AI anti-fraud education for older adults but also explores the application pathways of educational games in promoting intergenerational emotional connection and digital literacy enhancement, holding significant theoretical and practical implications.

2. Literature Review

2.1 Older Adults' Cognition of AI and Physiological and Psychological Factors in Fraud Victimization

Older adults generally have low levels of 认知 regarding artificial intelligence, which directly affects their ability to distinguish AI-generated content. Research indicates that many older adults struggle to differentiate between real photographs and AI-synthesized images, particularly when the images involve relatives or authoritative figures, leading to trust bias

(Chung & Yeung, 2023). Physiologically, reduced information processing speed, diminished visual discrimination ability, and limited working memory capacity make it more challenging for older adults to make rapid judgments about image authenticity. Additionally, generational digital literacy gaps contribute to older adults' unfamiliarity with and anxiety about new technologies, further reducing their willingness to actively verify information authenticity.

Regarding psychological factors, loneliness, social isolation, and strong needs for authority and emotional connection are significant drivers of older adults' vulnerability to fraud. Lei Xiaoyan et al. (2022), based on data from the China Health and Retirement Longitudinal Study (CHARLS), found that while older adults with relatively better economic conditions are more likely to become fraud targets, those with smaller social circles and increased emotional dependence find it more difficult to escape predicaments after actual victimization. Fraudsters often exploit older adults' concern for family members, using AI technology to forge scenarios of relatives seeking help, precisely targeting their emotional vulnerabilities. Song Lingyao (2024), through grounded theory research, constructed a four-element interactive psychological mechanism model of older adult fraud victimization, emphasizing the dynamic process of "target system — dynamic interaction system — action intervention system — action execution system," wherein emotional vacancy and trust propensity are core driving factors. These physiological and psychological characteristics collectively constitute older adults' particular vulnerability to AI-enabled fraud and provide targeted entry points for educational interventions.

2.2 Literature on AI-Enabled Fraud

The misuse of generative artificial intelligence technology has significantly exacerbated fraud risks targeting older adults. In recent years, fraudsters have widely employed AI image generation, voice cloning, and deepfake technologies to produce highly realistic fake photos, videos, and audio, impersonating relatives seeking help, authoritative institution notifications, or celebrity endorsements to commit fraud (Zhai et al., 2025). Zhai et al. (2025), through participatory design research, pointed out that deepfake fraud has become a novel threat to older adults, characterized by strong concealment and precise emotional manipulation, often leading victims to suffer severe economic losses and psychological trauma. Herrera et al. (2024) further analyzed the evolution of AI-enhanced fraud, emphasizing that the "compound fraud" model combining voice cloning and image synthesis poses a particularly prominent threat to older adults.

In the Chinese context, AI fraud is also rapidly increasing. Research by Lei Xiaoyan et al. (2022) showed that the characteristics of fraud cases experienced by older adults in the digitalization process are closely related to the depth of internet use, and the intervention of AI technology has shifted fraudulent tactics from traditional speech-based methods to simultaneous visual and auditory forgery. Relevant case analyses indicate that fraudsters often exploit older adults' trust in "grandchildren," "children," or "experts," using AI-generated "emergency 求助" images or videos to commit 精准 fraud. These studies collectively reveal the double-edged sword effect of AI technology in fraud and highlight the urgency of improving older adults' AI image recognition abilities and digital literacy.

2.3 Literature on Educational Games

Educational games and serious games have accumulated substantial empirical evidence in the fields of cognitive training and health promotion for older adults. Koivisto and Malik (2021) systematically reviewed gamification intervention studies targeting adults aged 55 and above, finding that gamification design positively impacts older adults' engagement, cognitive function, and social connection, particularly leveraging their life experience advantages for contextualized learning. Abd-Alrazaq et al. (2023)'s meta-analysis further confirmed that serious games significantly outperform control groups in improving verbal learning among older adults with cognitive impairment, demonstrating the effectiveness of game mechanisms in reducing cognitive load and enhancing motivation.

Gutiérrez-Pérez et al. (2023) conducted a systematic review of 108 empirical studies on serious games involving older adults, finding that games positively impact physical, cognitive, and social dimensions, with intergenerational interaction games particularly helping to reduce loneliness and promote family communication. Wang et al. (2021)'s meta-analysis also showed that game-based brain training significantly improves processing speed, selective attention, and short-term memory in community-dwelling older adults. These studies provide theoretical and practical support for transforming AI anti-fraud knowledge into game tasks, while emphasizing the importance of age-friendly design (large fonts, high contrast, simplified operations, low-pressure feedback). Overall, educational games and serious games offer a learning pathway for older adults that combines entertainment with education, particularly suitable for skill training scenarios requiring repeated practice and immediate feedback.

2.4 Transformation of Knowledge into Gamified Formats

Transforming specialized knowledge into a gamified format is not a simple matter of text transfer but requires systematic decomposition into perceptible task objects, actionable behavioral sequences, and feedback-providing interaction mechanisms. Multimodal learning theory emphasizes that appropriate integration of images, text, speech, and physical operations supports learners' deep understanding of complex concepts. Sociocultural learning theory points out that contextual embedding and social interaction are key to cognitive development, providing a solid theoretical foundation for family co-play and intergenerational cooperation models.

In the specific knowledge domain of AI anti-fraud, flaw features are highly visual and observable, making them suitable for transformation into game mechanisms familiar to older adults, such as "spot the difference," "matching," and "judge true/false." The key is to transform each type of flaw (e.g., abnormal finger count, shadow direction inconsistency, lighting inconsistency) into independent, repeatable recognition tasks and to help older adults establish correct judgment patterns through immediate feedback. Educational game design must consider cognitive load theory to avoid information overload while leveraging older adults' contextual judgment advantages, transforming abstract AI recognition knowledge into concrete, perceptible game actions. The introduction of intergenerational cooperation scenarios can not only reduce older adults' technological anxiety but also achieve the dual goals of knowledge transfer and emotional support through natural conversation, thereby realizing an effective transformation from "knowledge 灌输" to "experiential learning."

3. Research Methods

3.1 Research Framework and Process

This study adopts a mixed-method approach combining literature analysis, expert interviews, needs assessment, design model construction, prototype development, and preliminary validation. First, typical AI flaw features were extracted through literature analysis and AI image detection research. Second, experts including psychologists and community police officers were invited to analyze the reasons older adults are susceptible to AI fraud and the methods of fraud. Third, older adults' preferences for game formats were understood through questionnaires and observation. Finally, knowledge features were transformed into card tasks, interaction mechanisms, and visual designs, followed by preliminary prototype evaluation

through playtesting.

3.2 Extraction of AI-Generated Image Error Forms

Through literature analysis and expert interviews, this study systematically extracted common error forms in AI-generated images. The extraction process followed four principles: observability (detectable without professional tools), typicality (high frequency in AI-generated images), comprehensibility (explainable in everyday language), and actionability (transformable into specific inspection actions). Twelve types of typical error forms were ultimately identified, including: counting fingers, examining ears, checking text, tracing shadows, observing teeth, feeling texture, verifying season, checking era, examining background, finding repetition, comparing common sense, and verifying lighting.

Each error form was transformed into a short core prompt, accompanied by intuitive icons and memory mnemonics. For example, "count fingers" corresponds to "a normal hand typically has five fingers"; "trace shadows" corresponds to "observe whether shadows of all objects in the image point in the same direction"; "verify lighting" corresponds to "check whether the reflective highlights in the left and right eyes are consistent." These error forms cover major flaws in AI-generated images regarding anatomical structure, lighting logic, and semantic consistency, with progressive difficulty levels suitable for older adults to learn and identify step by step.

3.3 Types of Fraud Against Older Adults

According to the "Report on Internet Usage and Risks Among Middle-Aged and Older Adults" jointly released in June 2018 by the Publicity Department of the Criminal Investigation Bureau of the Ministry of Public Security and the National Office on Aging, and produced by the People's Daily Online Public Opinion Data Center and Tencent Corporation, the highest-risk incidents encountered by middle-aged and older adult internet users include online rumors (66.2%), false advertising (52.7%), online fraud (37.4%), and vulgar/obscene content (29.6%). Among the various types of online fraud encountered by middle-aged and older adults, health product fraud accounts for 30.4%, red envelope fraud 25.1%, and lottery fraud 24.2%. Additionally, many middle-aged and older adults have encountered online pyramid schemes (16.9%), wealth management fraud/illegal fundraising (16.4%), impersonation of public security, procuratorate, and court officials (15.3%), online shopping fraud (14.9%), gaming fraud (6.5%), and romance fraud (6.1%).

With the development of generative AI technology, fraud types have further evolved. Fraudsters use AI image generation, voice cloning, and deepfake technologies to create highly realistic fake photos and videos, executing precise fraud targeting older adults, such as forging scenarios of relatives seeking help or authoritative institution notifications. These new AI fraud methods are more concealed and place higher demands on older adults' discrimination abilities, forming an important real-world backdrop for this study's focus on improving AI image recognition capabilities.

3.4 Needs Analysis for Older Adult Anti-Fraud Learning

The needs analysis included a questionnaire survey of community-dwelling older adults and elderly care workers, as well as focus group interviews with older adults. The questionnaire used a five-point Likert scale to assess suitability across dimensions including task challenge, role interaction, feedback clarity, and the balance between entertainment and learning. Focus group interviews focused on older adults' familiarity with and acceptance of game formats such as "spot the difference," "matching," and "pairing," as well as their willingness to engage in intergenerational co-play.

Results showed that the vast majority of respondents were familiar with and enjoyed games like "spot the difference" and "matching." More than 80% of respondents expressed willingness to play "spot the flaw" games with their children or grandchildren. Regarding game difficulty, respondents preferred starting with obvious flaws (e.g., six fingers) and gradually progressing to more subtle errors (e.g., lighting inconsistencies, texture anomalies). These needs provided important bases for the game prototype's task design, difficulty grading, and interaction mode design.

4. Game Prototype Design

4.1 Card System Architecture

"True Sight" is a physical card game comprising 108 basic cards, divided into three categories, as shown in Table 1.

Table1 Regarding the Quantity and Introduction of Game Cards

Card Type	Quantity	Function
Image Cards	72	36 real photos + 36 AI-generated images (covering 12 flaw types, 3 per type, with difficulty levels)

Card Type	Quantity	Function
Feature Prompt Cards	12	Each corresponds to one flaw type, providing recognition methods and core prompts
Special Function Cards	8	Detail Magnifier, Anti-Fraud Assistant, Quick Judgment, Family Discussion, Cooperative Investigation, Anti-Fraud Quiz, Share Experience, Help Hotline

The game supports two modes: Solo Mode uses "Keen Eye Match" mechanics, suitable for older adults practicing quietly alone; Family Mode uses "Truth Relay" mechanics, where children and parents team up to analyze images and collaboratively determine authenticity.

4.2 Age-Friendly Visual Design

Card dimensions are 63mm × 88mm, printed on 300gsm art paper with matte lamination. The design follows age-friendly principles: minimum font size 22pt, title font size 32pt bold; avoidance of simultaneous red-green color use; rounded corners to prevent scratches; each feature prompt card features an intuitive icon and memory mnemonic. NFC chips are embedded on the back of the cards. By tapping with a mobile phone, the device indicates whether the image on the card is AI-generated, as shown in the figure.

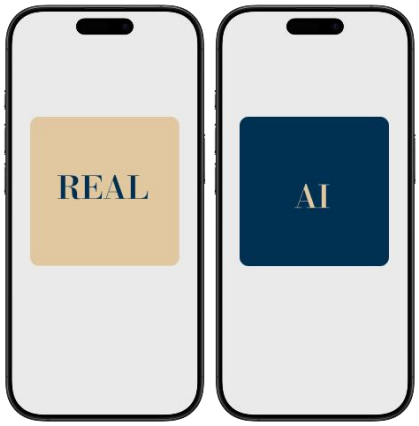

Figure1 NFC verification illustration

4.3 Transformation of Knowledge into Game Tasks

The 12 flaw features are transformed into specific inspection tasks. For example, "count fingers" corresponds to "count the number of fingers on the person in the image"; "trace shadows" corresponds to "observe whether shadows of all items point in the same direction"; "verify lighting" corresponds to "check whether the reflective highlights in the left and right eyes are consistent." During gameplay, each image card can be repeatedly observed, discussed, and judged. Upon making a judgment, players tap the NFC to verify the answer

and view detailed explanations.

4.4 How to Play the Game

Solo Mode (Keen Eye Match)

Players arrange 36 image cards face up in a 6×6 grid. Each time, players flip two cards, observe the image content, and determine whether it is a real photo or an AI-generated image. After making a judgment, players tap the NFC chip on the card back with their mobile phone, and the system immediately provides correct answer feedback along with an analysis of the AI flaws in that image. Correct judgments earn points; incorrect judgments require re-observation. Players can use the Feature Prompt Cards at any time to review the recognition points for the 12 flaw types, helping them progressively build judgment experience, as shown in the figure.

Figure2 Solo mode gameplay illustration

Family Mode (Truth Relay)

Each player holds 10–12 image cards, with 5 Feature Prompt Cards and Special Function Cards placed in the center. Players take turns playing an image card, optionally either truthfully describing the image content or "lying." Other players must judge whether the card player is lying and vote by raising their hands. Correct judgments earn points; successful lying also earns points. Players can use Special Function Cards (e.g., "Detail Magnifier," "Family Discussion") to obtain additional clues or initiate group discussions. All cards can be verified for authenticity via NFC, with the system providing detailed flaw analysis and instructional feedback, as shown in the figure.

Figure3 Family mode gameplay illustration

Both modes support repeated practice. Players can choose to train alone or play with family members according to their own circumstances, enhancing their ability to recognize AI-generated images through relaxed interaction.

5. Conclusion

Addressing the lack of interactivity and family scenario integration in AI anti-fraud education for older adults, this study systematically conducted the following work: through literature analysis and expert interviews, 12 types of AI-generated image flaw features suitable for older adults to recognize were extracted; a physical card game system comprising image cards, feature prompt cards, and special function cards was constructed; a game prototype supporting both solo practice and family intergenerational cooperation modes was designed; and a design pathway for transforming knowledge into gamified formats was proposed. These efforts provide a comprehensive design framework for converting specialized AI image recognition knowledge into game experiences that are understandable, actionable, and repeatable for older adults.

The main contribution of this study lies in transforming complex AI anti-fraud knowledge into a game mechanism centered on task-driven learning, immediate feedback, and intergenerational interaction, exploring the application potential of educational games in improving digital literacy and fostering family emotional connections among older adults. The proposed design model emphasizes cognitive load control, age-friendly visual presentation, and sociocultural contextual embedding, offering a referable theoretical and practical pathway for the development of similar educational games.

This study has certain limitations. First, the research currently focuses primarily on the conceptual design and system construction of the game prototype, with formal prototype validation not yet conducted. Second, sample size and diversity of application scenarios need to be expanded. Future research will conduct prototype validation in real-world community and family environments, employing pre-post test designs, behavioral observations, and longitudinal tracking to systematically evaluate the game's actual effectiveness in improving older adults' AI image recognition abilities, enhancing anti-fraud awareness, and promoting intergenerational interaction. Further optimization of difficulty grading, voice assistance, and personalized learning pathways will also be pursued to enhance the scientific rigor and generalizability of educational games in AI anti-fraud education for older adults.

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