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Exploration of 'Gaming Literacy'-Based Teaching and Training Models in Higher Vocational Colleges

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Abstract: Facing challenges such as declining participation and low knowledge retention in traditional vocational education systems, this study proposes a teaching reform framework centered on "gaming literacy" based on educational psychology and cognitive science theories. By constructing a strategic stochastic generation system, a multidimensional instant feedback mechanism, and a growth-oriented incentive cycle, this framework systematically addresses three core issues in traditional teaching: classroom passivity, diminished learning motivation, and lack of feedback mechanisms. Through neural reward cycles that stimulate deep learning motivation and reconfigure cognitive load distribution, this research provides a scientifically grounded and practical direction for vocational education reform.

1. Introduction

With advancements in educational psychology and cognitive science, the game-based competency model (GBC) has emerged as an interdisciplinary educational concept capable of transcending the limitations of traditional training methods and fostering a new learning ecosystem in higher vocational education.

Current issues such as declining student engagement and low knowledge retention rates highlight the bottlenecks of conventional training systems in higher vocational institutions. In contrast, neurobiological studies demonstrate that gamified designs driven by dopamine reward mechanisms can improve memory retention by over 65% [1,2].Beyond knowledge retention, gamified training models exhibit unique advantages in motivation activation, cognitive restructuring, and team collaboration. Thus, integrating gamified design into traditional teaching to harness "gaming literacy" is a critical research focus. Here, gaming literacy is defined as the multifaceted competencies stimulated through game mechanics, modes, and elements in teaching. To avoid superficial entertainment-oriented modifications, its development requires reconstructing training scenarios through goal-setting, instant feedback, and challenge gradients, ensuring learners' cognitive load remains within Vygotsky's Zone of Proximal Development (ZPD) [3].

2. Pain Points in Traditional Training

2.1. A Teacher-centered classrooms with low student participation

Predominance of one-way lecture-based instruction, over-reliance on didactic teaching methods, and neglect of constructivist pedagogy.

Homogenized assignments lacking scenario-based simulations or collaborative inquiry, resulting in minimal student participation in learning and practice.

2.2. Diminished learning motivation

Standardized assignment formats lead to 'pseudo-mastery', where students can solve problems mechanically but fail to transfer knowledge or engage in deep, critical thinking.

2.3. Absence of feedback mechanisms

Delayed, fragmented, and non-personalized feedback (both in-class and post-class) prevents meaningful correlation between learning outcomes and progress.

The introduction of gaming literacy will strategically address these systemic issues. By embedding gamified structures into classroom curricula through systematic design, a three-tiered objective framework is achieved: the foundational goal of knowledge transformation to meet instructional targets, the advanced goal of solidifying competency development and enhancing knowledge transfer efficiency, and the concurrent psychological empowerment to elevate procedural engagement across learning outcomes, training feedback, and experiential dimensions.

3. Core Characteristics of Gaming Literacy

In Gaming Literacy: <A Practical Guide to Competitive Game Design>, veteran game designer Cheng Tao identifies three core elements of gaming literacy: randomness, feedback, andprogression. These elements, which drive repeated participation and immersion in games, are precisely what traditional teaching lacks [4]:

3.1. Randomness and Strategy

Random elements (e.g., card draws, skill triggers) attract repeated attempts while strategic choices deepen

Engagement. For example, Marvel All-Starsemploys 12-card random combinations to structure six-round rapid battles.

3.2. Feedback Mechanisms

Rapid, frequent, and clear feedback (e.g., critical hit effects, damage values) reinforces a sense of achievement.

3.3. Progression Systems

Long-term goals such as character upgrades and equipment enhancements sustain engagement. Fig 1.shows the interconnections of three key elements.

In summary, the golden rule of game design — 'Randomness creates surprise, strategy provides control, feedback reinforces presence, and progression gives meaning' — constitutes the neurocognitive foundation of modern interactive experiences. This principle not only applies to entertainment gaming but also demonstrates robust cross-domain applicability in fields such as education and healthcare.

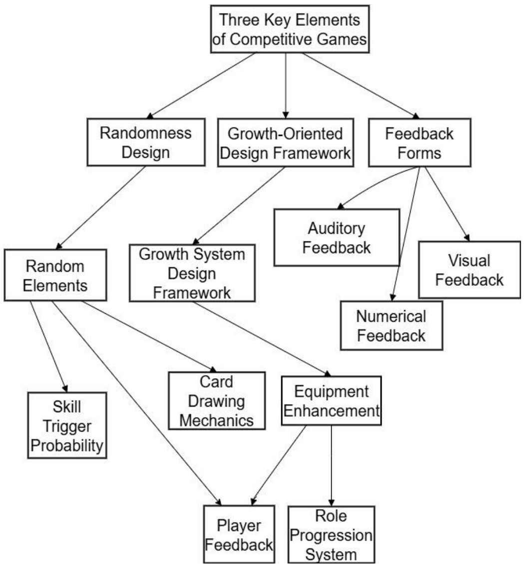

Fig. 1 Three Key Elements and Their Interconnection

These elements can be adapted to higher vocational education:

3.4. Strategic Randomness

Design random elements and construct combination strategies. Combine knowledge/skill points in varied forms to create game-based instructional frameworks, fostering knowledge transfer and improving training efficiency.

3.5. Instant Feedback

Establish feedback mechanisms to enhance the sense of achievement. Replace traditional 'lecture-assignment-grading' with gamified feedback emphasizing timeliness and individualization, distinguishing betweenphase-specific feedback (e.g., milestones) andoverall feedback (e.g., course objectives). The feedback mechanisms in educational games must simultaneously ensure learning efficacy and behavioral motivation, requiring designs that integrate cognitive science, gamification principles, and pedagogical theory, as shown in Fig. 2.

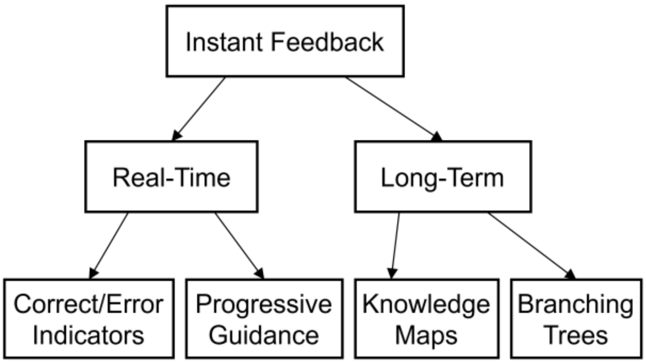

Fig. 2 Instent Feedback method

3.5.1. Real-Time Feedback Forms

Correct/Error Indicators:
Immediate visual animations (green√/red×) displayed post-answer submission.
Progressive Guidance:
Dynamic code highlighting in programming games to pinpoint error locations.

3.5.2. Long-Term/Comprehensive Feedback Forms

Knowledge-Level Mapping:
Visual representations such as timelines and branching tree models to track learning progression.

3.6. Progression-Based Incentives

Level up tasks/stages to establish long-term goals. Integrate points, badges, and role-leveling into evaluations, establishing hybrid short- and long-term incentives for individuals and teams. Fig. 3. shows the level-up logic diagram.

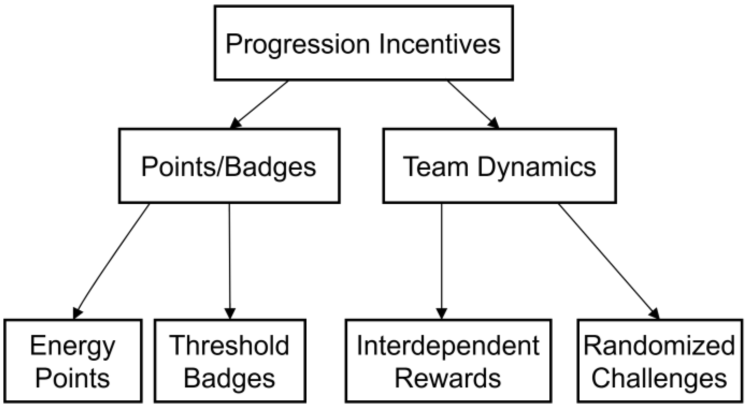

Fig. 3 The Level-up Logic Diagram

Examples:

3.6.1. Real-Time Points Feedback

Unlocking "Energy Points" upon completing knowledge units, visualized through progress bars and point trackers.

3.6.2. Badge Achievements

Awarding badges when reaching preset thresholds (e.g., top 10% in competitions or cumulative points ≥500).

3.6.3. Collaborative Dynamics

Individual-Team Interdependence: Personal rewards/punishments linked to collective outcomes (e.g., 20% bonus points for team milestones).

Randomized Collaboration Events: Triggered challenges requiring joint problem-solving (e.g., ‘Group Code Debugging’ with shared rewards).

Table 1 presents a tiered incentive system between individuals and teams, where individual rewards/penalties are interlinked with collective outcomes, regulated through predefined trigger mechanisms.

Table 1: Integrated Incentive Framework

Mechanism	Individual Action	Team Impact	Trigger Condition
Rewards	+50 Energy Points	+10% Team Progress	Accuracy ≥90% in 3 consecutive tasks
Penalties	-30 Energy Points	5-min Skill Lockout	3+ unanswered errors in 24 hours

4. Principles for Gamified Training Design

4.1. Align Game Mechanics with Instructional Objectives

Using teaching objectives as the foundational logic, integrate training goals and game content in a deeply cohesive manner.At its core, the ultimate aim of teaching and training is the acquisition of concrete knowledge and skills. The introduction of "gaming power" must fundamentally serve this pedagogical purpose. Thus, the design of game content and mechanics must be inherently tied to and dependent on training objectives, avoiding superficial gamification for its own sake.

In practice, a viable approach is to align teaching objectives with the progression of instruction (e.g., referencing textbook chapters or decomposing them into phased tasks of a typical project). Based on the distinct characteristics of each learning phase, these objectives can then be mapped to corresponding stages within a single game or a combination of multiple games.

Example: The ‘level-based challenge’ in programming training exemplifies this well. By breaking down complex skills into achievable subtasks, it simultaneously accomplishes goal attainment and constructs the simplest form of game design.

4.2. Quantify Competency Progression

With competency development as the progressive goal, establish quantifiable alignment between tiered feedback and gameplay progression.

Neuroimaging studies reveal that unlocking achievements in gamified tasks triggers increased dopamine release. This neural reward mechanism creates a positive reinforcement loop, fostering sustained engagement and incremental mastery among participants—a trait inherent to gaming that aligns precisely with the demands of vocational training in higher education. It effectively counteracts common issues such as diminished learning motivation and inadequate endurance in prolonged training.

By accelerating competency generation through game-based training, we stimulate trainees’ dopamine secretion and organize progressive objectives within their Zone of Proximal Development (ZPD). This approach constructs a layered ‘level-clearing’ experience, where each milestone bridges the gap between current abilities and advanced skill acquisition.[5.6].

4.3. Learner-Centered Psychological Shifts

Guided by the principle of ‘learner-centeredness’, establish a psychological shift from passive training to assuming the role of a game protagonist.

Within the framework of game-based training, educators construct a novel pedagogical ecosystem where students become protagonists in the gameplay narrative. This transforms their role from passive recipients of knowledge to active controllers of the gaming process, with the altered psychological status fundamentally reshaping their learning engagement.

On one hand, acknowledging the heterogeneity of individual achievement motivation, the design employs real-time feedback mechanisms to foster self-awareness. On the other hand, intentionally embedded ‘controlled crises’ within the game environment cultivate a stabilized stress response mentality. Military psychology experiments demonstrate that soldiers trained through gamified stress scenarios exhibit significantly reduced fluctuations in prefrontal cortex blood oxygenation levels (BOLD signals) under high-pressure conditions [7,8]. This is attributed to the deliberate integration of ‘controlled crises’ in game design:

Time Pressure: Timed evaluation modes (e.g., countdown-based missions).

Resource Constraints: Competitive tasks with limited resources (e.g., supply allocation challenges).

Information Ambiguity: Multi-source noise interference in intelligence analysis (e.g., conflicting data inputs)."

4.4. Avoid Over-Entertainment

Preventing Cognitive Goal Deviation Caused by Excessive Entertainment

As a final principle, educators must guard against the over-gamification of training that may lead to cognitive objective misalignment. Games should be positioned as auxiliary tools rather than ultimate goals, requiring a deliberate equilibrium between pedagogical rigor and gaming engagement.

Under game-based training frameworks, two critical safeguards must be implemented:

Avoiding Form Over Substance: Ensure students focus on knowledge acquisition rather than game points (e.g., by aligning scoring mechanisms with competency metrics).

Eliminating Achievement Substitution: Prevent game reward systems from replacing learning objectives (e.g., designing badges to reflect skill mastery tiers, not just completion).

This balance is exemplified in programming drills where ‘level completion’ requires demonstrable code proficiency—not merely time spent playing. Gamified Training Design Relationship Diagram is shown in Fig. 4.

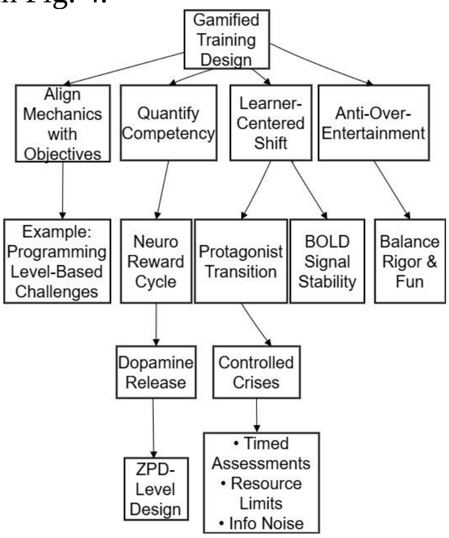

Fig. 4 Gamified Training Design Relationship Diagram

5. Conclusion

Gaming literacy is reshaping the foundational logic of modern training. By integrating cognitive principles with game mechanics, educators can build dynamic learning ecosystems, offering new methodological insights for higher education reform.

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