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Research on Reconstructing the Educational Value of Failure Experiences in Gamified Learning

Wang Lei

Hubei University of Economics, Wuhan 430205, Hubei, China

Abstract: This study explores the reconstruction of the educational value of failure experiences in gamified learning, aiming to provide theoretical and practical guidance for optimizing learning processes. The research systematically analyzes the current status and problems of failure experiences in gamified learning, and clarifies their educational values in three dimensions: cognitive development, emotional attitudes, and social skills. Theoretically, failure experiences can stimulate learners' reflection, deepen knowledge understanding, cultivate critical thinking, enhance frustration tolerance, motivate learning, and improve social interaction abilities. Practically, strategies for reconstructing educational value are proposed, including goal-oriented design with contextual elements, cognitive guidance through failure education and role models, and interactive reinforcement via timely feedback and technological tools. Empirical results show that the experimental group using reconstructed strategies significantly outperforms the control group in learning motivation, academic performance, and attitudes toward gamified learning. The study fills academic gaps in gamified learning theories, offers actionable insights for educators and developers, and highlights the need for expanded sample scope, enhanced qualitative research, and long-term strategy validation in future studies.

Keywords: Gamified learning; Failure experiences; Educational value; Reconstruction strategy; Cognitive development; Emotional attitudes; Social skills

1 Introduction

1.1 Research Background

1.1.1 The Rise and Development of Gamified Learning

With the rapid advancement of information technology and the continuous update of educational concepts, gamified learning has gradually emerged and gained widespread attention. Gamified learning integrates game elements and mechanisms into traditional learning processes, aiming to enhance learners' participation and motivation by increasing the fun and interactivity of learning. Historically, early educational games were relatively simple, mainly presenting basic learning content in game forms, such as simple word-spelling games or math-operation games. However, with technological progress, the forms of gamified learning have become increasingly diverse, incorporating cutting-edge technologies like virtual reality (VR) and augmented reality (AR), which enable learners to immerse themselves in various learning scenarios. For example, in history learning, VR technology can recreate historical scenes, allowing students to feel as if they are in a specific historical period and enhancing their perception and understanding of historical events. Meanwhile, the application scope of gamified learning has expanded from basic education to higher education, vocational training, and corporate internal training. In corporate training, simulations of business scenarios through games help employees improve their professional capabilities and teamwork skills. This rise and development reflect the education sector's reflection on traditional teaching methods and active exploration of innovative learning models.

1.1.2 The Current Status and Attention to Failure Experiences in Gamified Learning

While gamified learning is booming, failure experiences, as a critical aspect, have not been sufficiently studied. Traditional gamified learning designs often focus more on enabling learners to complete tasks successfully and obtain rewards to reinforce motivation, while neglecting the potential value of failure experiences in the learning process. In fact, failure is an inevitable part of learning, which can prompt learners to reflect on their behaviors, adjust learning strategies, and achieve deeper learning. In some complex gamified learning scenarios, learners may encounter frequent failures—for instance, in simulated entrepreneurship games, failures may occur due to misjudgments of market trends or improper financial management. Currently, however, there is relatively little research and practice on how to design failure experiences reasonably to both stimulate learners' motivation and prevent them from giving up due to excessive frustration. Although some researchers have begun to focus on this field in recent years, the study of failure experiences in gamified learning remains largely in its infancy and urgently requires more exploration and attention.

1.2 Research Objectives and Significance

1.2.1 Research Objectives

This study aims to deeply explore the design and application of failure experiences in gamified learning. Specific goals include: analyzing the manifestations and influencing factors of failure experiences in different types of gamified learning scenarios; constructing a scientific and reasonable failure experience design model to guide the development of gamified learning products; and verifying the impact of the designed failure experiences on learners'

academic performance, motivation, and emotional attitudes through empirical research. Achieving these objectives is expected to provide more targeted and effective design strategies for failure experiences in gamified learning, optimize the learning process, and enhance learning quality.

1.2.2 Theoretical Significance

Theoretically, this study contributes to enriching the theoretical framework of gamified learning. Current theoretical research on gamified learning mostly focuses on the application of game elements and the stimulation of learning motivation, with relatively limited discussions on failure experiences. This study will deeply analyze the internal relationship between failure experiences and the learning process, and reveal the mechanisms by which failure experiences promote learners' knowledge construction, skill development, and emotional growth from multidisciplinary perspectives such as cognitive psychology and educational psychology. This not only provides new perspectives and content for improving gamified learning theories but also expands the research scope on learning processes and mechanisms in the education field, offering a theoretical foundation and reference for subsequent related studies.

1.2.3 Practical Significance

Practically, the research results have important application value. For educators, understanding how to design effective failure experiences can help them better use gamified learning methods in teaching, guide students to face failures correctly, and learn from them to improve learning outcomes. For example, when designing online courses, educators can reasonably set levels and challenges based on the failure experience design model proposed in this study, allowing students to grow through moderate failures. For game developers, the failure experience design strategies provided by this study can guide them to create more educationally valuable gamified learning products and enhance user experience and educational effects. Additionally, for corporate training departments, introducing scientifically designed failure experiences can improve the quality and efficiency of employee training, cultivating their problem-solving abilities and adaptability to changing market environments.

1.3 Research Methods and Technical Route

1.3.1 Research Methods

Literature Research Method: Extensively collect academic literatures, research reports, and relevant policy documents on gamified learning, failure experiences, and educational psychology at home and abroad. Through systematic review and analysis of these literatures, gain insight into the research status, development trends, and existing problems in the field, providing a solid theoretical foundation and research starting point for this study.

Case Analysis Method: Select representative gamified learning cases, including educational games and gamified modules in online learning platforms, and conduct in-depth analysis of the design and application of failure experiences in these cases. Through comparative analysis of different cases, summarize successful experiences and shortcomings, providing practical evidence for proposing failure experience design strategies later.

Empirical Research Method: Design and carry out empirical studies by selecting appropriate research subjects (e.g., school students or corporate employees). Divide the subjects into an experimental group and a control group, where the experimental group adopts a gamified learning scheme with failure experiences designed based on this study, while the control group uses traditional gamified learning schemes. Collect data on learners' academic performance, motivation, and attitudes through pre-tests, post-tests, and process evaluations, and use statistical methods to analyze the data and verify the impact of the designed failure experiences on learning outcomes.

1.3.2 Technical Route

The technical route of this study is as follows: First, clarify research questions and objectives through literature research and construct a theoretical framework. On this basis, use case analysis to summarize the experiences and problems of failure experience design in existing gamified learning cases. Then, propose failure experience design models and strategies based on theoretical research and case analysis. Next, design an empirical research plan, including subject selection, experimental variable control, and development of data collection tools. Implement the empirical study, collect and analyze data, and verify research hypotheses. Finally, optimize and refine the failure experience design models and strategies based on empirical results, form research outcomes, and promote their application.

1.4 Research Content and Innovations

1.4.1 Overview of Research Content

This study focuses on failure experiences in gamified learning, with specific content including: 1) Clearly defining relevant concepts of gamified learning and failure experiences to clarify the research scope; 2) Deeply analyzing the mechanisms of failure experiences in gamified learning, discussing their impacts on learners from cognitive, emotional, and behavioral dimensions; 3) Summarizing common patterns and problems in current failure experience design through analysis of numerous cases; 4) Constructing a scientific and reasonable failure experience design model based on theoretical research and practical analysis, including the design of key elements such as failure frequency, intensity, and feedback methods; 5) Verifying the effectiveness of the constructed failure experience design model through empirical research and exploring its impacts on learners' academic performance, motivation, and emotional attitudes.

1.4.2 Innovations

Theoretical Perspective Innovation: This study adopts a multidisciplinary integration perspective, comprehensively applying knowledge from educational psychology, cognitive psychology, and game design theory to deeply analyze the mechanisms of failure experiences in gamified learning. Compared with previous single-discipline studies, this multidisciplinary approach can more comprehensively and deeply understand the internal relationship between failure experiences and learning processes, providing new ideas and methods for the development of gamified learning theories.

Failure Experience Design Innovation: This study proposes a failure experience design concept based on "personalization" and "dynamic adjustment." Traditional failure experience designs often use uniform standards and models, ignoring learners' individual differences and the dynamics of the learning process. In contrast,

this study designs failure experiences according to learners' learning styles, knowledge levels, and progress, and dynamically adjusts failure difficulty and feedback methods based on learners' real-time performance during learning to better meet their needs and improve learning outcomes.

Research Method Innovation: In empirical research, this study will comprehensively use multiple data collection methods. In addition to traditional questionnaire surveys and test scores, advanced technical tools such as eye-tracking and EEG monitoring will be introduced to collect physiological and psychological data (e.g., cognitive load and emotional engagement) during learners' gamified learning processes. Through integrated analysis of multi-source data, this approach can more accurately evaluate the impact of failure experiences on learners and provide more scientific and precise evidence for failure experience design.

2 Related Theories and Research Review

2.1 Theories Related to Gamified Learning

2.1.1 Conceptual Definition of Gamified Learning

Gamified learning, in simple terms, refers to the use of game-like approaches for learning, where teachers utilize games to convey specific knowledge and information to learners. It mainly includes two categories: digital games and game activities. In educational contexts, gamified learning integrates game elements such as points, leaderboards, badges, and tasks into non-game learning environments to enhance the (fun) and attractiveness of learning, thereby stimulating learners' intrinsic motivation and participation. For example, in language learning, role-playing game activities can be designed to allow students to use the target language for communication in simulated real-life scenarios, making the learning process more contextual and interactive. This learning approach aims to break the monotonous pattern of traditional teaching, enabling learners to acquire knowledge and improve skills in a relaxed and enjoyable atmosphere.

2.1.2 Theoretical Foundations of Gamified Learning

Behaviorist Learning Theory: This theory emphasizes that learning is a connection between stimuli and responses, with behavior shaped through reinforcement. In gamified learning, elements like points and rewards can be seen as reinforcements for learners' correct behaviors, prompting them to repeat desired learning actions. For instance, when a student solves a math problem and receives point rewards, this positive reinforcement motivates them to solve more problems, thereby enhancing their mathematical abilities.

Cognitivist Learning Theory: Focused on the study of learners' internal mental processes, this theory views learning as an information-processing activity. Various tasks and challenges in gamified learning can be regarded as information inputs, which learners process through thinking, analysis, and problem-solving to internalize knowledge. For example, in puzzle-based gamified learning, students must use existing knowledge and logical thinking to solve puzzles, a process that involves information processing and knowledge construction.

Constructivist Learning Theory: This theory emphasizes learners' active constructive role in the learning process, arguing that learning occurs when learners, in a specific context and with the help of others (including teachers and peers), use necessary learning materials to construct meaning. Gamified learning provides rich contexts and interactive opportunities, where learners interact with the environment and peers through exploration and trial, constructing their own understanding of knowledge. For example, in simulation business games, students understand the principles of economic management through practicing virtual enterprise operations.

2.2 Research on Failure Experiences

2.2.1 Research Findings on Failure Experiences in Psychology

In the field of psychology, failure experiences have been widely studied, with research showing their multifaceted impacts on individual psychology. Emotionally, failure often triggers negative emotions such as frustration, anxiety, and disappointment. For example, individuals who fail an important exam may fall into self-blame and frustration, doubting their own abilities. However, appropriate failure experiences can also serve as opportunities for growth. Some studies have found that if individuals correctly attribute failure—attributing it to insufficient effort rather than ability deficits—they may be motivated to strive for success, learning from failures to adjust their behavioral strategies and achieve better results in subsequent tasks. Additionally, failure experiences are closely related to self-efficacy. Continuous failures may reduce self-efficacy, making individuals lack confidence in their ability to complete tasks, while occasional failures overcome with success may enhance self-efficacy, enabling individuals to believe in their capability to meet challenges.

2.2.2 Research Status of Failure Experiences in Education

In the education field, failure experiences have also received attention, with studies highlighting their significant impact on students' learning and development. On one hand, excessive failure experiences may lead to weariness of learning and reduced motivation. For example, students who frequently fail in math learning may gradually develop fear and avoidance of the subject. On the other hand, rational use of failure experiences can promote learning. Teachers can guide students to reflect on failures, analyze causes of errors, and deepen their understanding and mastery of knowledge. Research has shown that in experimental teaching, students' failure experiences (such as failed experiments) can enrich their learning experiences, prompting them to think about improving experimental methods and enhancing practical abilities. For instance, Zong Guoqing and Chen Mingrui used educational phenomenological methods to study students' experimental failure experiences and concluded that chemistry experiment failures (including accidents) involve rich experiences, whose enhancement or reduction is influenced by multiple factors (teacher guidance, peer cooperation and competition, personal efforts, and time) acting singly or interactively. Moreover, numerous studies on the manifestations and impacts of failure experiences across different subjects and age groups provide theoretical bases for educators to guide students in coping with failures.

2.3 Research Progress on Failure Experiences in Gamified Learning

2.3.1 Key Focuses of Existing Research on Failure Experiences in Gamified Learning

Existing research primarily focuses on the impacts of failure experiences in gamified learning on learners' motivation and behavior. On one hand, studies have found that failure experiences may negatively affect learners' motivation. If failures in games are too frequent or insurmountable, learners may feel frustrated and reduce their enthusiasm for participating in gamified learning. For example, in competitive gamified learning, frequent failures may make learners feel inferior to others and lose motivation to continue. On the other hand, some studies suggest that moderate failure experiences can stimulate learners' desire to challenge and explore. When learners encounter failures but believe they can overcome them through effort, they may become more engaged in attempts to achieve success. Additionally, existing research has focused on optimizing failure experiences through game design—for example, setting reasonable failure feedback mechanisms that enable learners to clearly understand the causes of failure and provide corresponding improvement suggestions to help them avoid repeated failures in subsequent games.

2.3.2 Gaps and Limitations in Current Research

Despite existing studies on failure experiences in gamified learning, several gaps and limitations remain. First, in terms of research methods, most studies rely on questionnaires and experimental methods, with few dynamic tracking studies on learners' real-time psychological and behavioral changes during gamified learning. This makes it difficult to fully understand how failure experiences evolve throughout the learning process and their long-term impacts on learning outcomes. Second, there is a lack of in-depth research on differences in failure experiences across different types of gamified learning (e.g., role-playing, puzzle-solving, simulation management). Different types of gamified learning have distinct characteristics and rules, and failure experiences may manifest and impact learners differently, but current research has not systematically analyzed these differences. Third, there is a shortage of research on specific strategies and methods for applying failure experience research results to practical teaching. Although we know theoretically that failure experiences are important for learning, more practical guidance is needed on how to cleverly design failure scenarios and guide students to cope with failures in real teaching.

3 Analysis of the Current Status of Failure Experiences in Gamified Learning

3.1 Common Forms and Application Scenarios of Gamified Learning

Gamified learning integrates game elements with the learning process to enhance learners' engagement and motivation. It is widely applied in various fields with diverse forms.

3.1.1 Application of Gamified Learning in School Education

In school education, gamified learning often takes the form of classroom interactive games and subject competition games. For example, in mathematics classes, teachers can design number-puzzle games where students compete in groups through quiz and problem-solving sessions, not only reinforcing mathematical knowledge but also cultivating teamwork and competitive awareness. In language classes, role-playing games can simulate real-life scenarios for students to practice dialogues, improving their language expression skills. This form transforms traditional boring knowledge learning into interesting game activities, allowing students to acquire knowledge in a relaxed and enjoyable atmosphere and enhancing their learning initiative.

3.1.2 Gamified Learning Models on Online Learning Platforms

Online learning platforms offer diverse gamified learning models. Many platforms adopt point systems, where learners earn points for completing tasks, participating in discussions, etc., which can be exchanged for virtual rewards or unlock new learning content to motivate continuous learning. Some platforms design learning levels similar to game challenges, where learners must pass the current level's test to proceed to the next stage, increasing the challenge and fun of learning. Additionally, leaderboard functions are common gamified tools, allowing learners to see their rankings within classes or the platform, stimulating competitive psychology and encouraging harder work.

3.1.3 Practices of Gamified Learning in Vocational Training and Other Scenarios

Gamified learning also plays a significant role in vocational training. For example, training for new employees can use simulated work scenario games to let them experience workflows and familiarize with business operations in virtual environments, which is more intuitive and practical than traditional training lectures. In the medical industry, gamified training scenarios designed with virtual reality (VR) technology allow medical staff to practice emergency treatment in simulated critical care situations, enhancing their emergency response capabilities. In finance, trading simulation games help practitioners understand market dynamics and trading strategies, improving their professional skills.

3.2 Presentation Forms of Failure Experiences in Gamified Learning

Failure experiences are an integral part of gamified learning, presenting in various forms and exerting different impacts on learners.

3.2.1 Types and Manifestations of Game Task Failures

Game task failures come in various types. One type is failing to achieve task objectives, such as failing to answer enough questions correctly within the time limit in a quiz game, leading to team competition failure, or failing to meet expected profit targets due to poor management in a simulation business game. Another type is failure caused by violating game rules, such as when a learner's role in a role-playing game violates the game's ethical norms or behavioral guidelines, resulting in task failure. In terms of manifestations, they may include pop-up "mission failed" prompts on the screen with warning sound effects, or negative feedback from character avatars, such as virtual characters showing frustrated expressions, making learners intuitively feel the failure.

3.2.2 Learners' Behavioral and Emotional Reactions to Failure Experiences

When encountering failure experiences, learners exhibit

different behavioral and emotional reactions. Some learners adopt a proactive attitude, regarding failure as a learning opportunity: they carefully analyze the causes of failure, adjust strategies, and try again to complete the task. For example, in programming learning games, when a program fails to run, some learners will carefully check the code and consult others until the problem is solved. However, many learners experience negative emotions such as frustration, anxiety, and a sense of defeat, which may lead them to give up further attempts or even develop resistance to gamified learning. For instance, after repeated failures in complex math problem-solving games, some students may believe they are not good at math, losing interest in both the game and the subject.

3.3 Problems Existing in Failure Experiences of Current Gamified Learning

Although failure experiences have significance in gamified learning, several issues need to be addressed.

3.3.1 Lack of Systematic Design for Failure Experiences

Many current gamified learning projects lack systematic planning in designing failure experiences. The criteria for failure are often arbitrarily set without fully considering learners' learning stages, ability levels, and learning objectives. For example, in some simple language learning games, excessively difficult tasks cause frequent failures for most learners, dampening their motivation. Meanwhile, feedback after failure is inadequate, with only simple "task failed" prompts and no specific improvement directions or suggestions, leaving learners confused about how to improve.

3.3.2 Widespread Negative Perceptions of Failure Experiences among Learners

Learners generally hold negative perceptions of failure experiences. In traditional educational concepts, failure is often seen as disgraceful and this view extends to gamified learning. When learners fail in game tasks, they easily engage in self-negation, attributing failure to insufficient ability. Moreover, failures in gamified learning may involve losses in rankings, points, etc., further increasing learners' fear of failure. For example, in gamified competitions on online learning platforms, failure may lead to lower rankings and fewer points, increasing psychological pressure and making it difficult for learners to correctly recognize the value of failure.

3.3.3 Weak Relevance between Failure Experiences and Learning Objectives

In some gamified learning scenarios, failure experiences are not closely linked to learning objectives. After task failure, learners do not clearly understand the relationship between failure and learning objectives, nor can they gain experience and lessons related to learning objectives from failure. For example, in some history knowledge learning games, when players fail in simulating historical event decision-making tasks, the game does not guide them to reflect on the internal connections between failed decisions and historical event developments, or how to acquire knowledge from correct historical decisions to deepen understanding of historical events. This disconnection prevents failure experiences from effectively promoting the achievement of learning objectives, reducing the effectiveness of gamified learning.

4 Analysis of the Educational Value of Failure Experiences in Gamified Learning

As an innovative educational approach, gamified learning integrates game elements into the learning process, offering learners unique experiences. Among these, failure experiences are not merely negative outcomes but possess rich educational value, facilitating learners' growth across multiple dimensions such as cognitive development, emotional attitudes, and social skills.

4.1 Value at the Cognitive Development Level

In gamified learning, failure experiences act as a key to unlocking new doors of cognitive development, exerting a profound influence on learners' learning processes and knowledge acquisition.

4.1.1 Stimulating Learners' Reflection and Self-Adjustment

When learners encounter failures in gamified learning, they are prompted to reflect on their behaviors and strategies. This reflection is a process of deep thinking, where learners review their decisions, action steps, and gaps from objectives in the game. For example, if a learner fails to solve a puzzle about a specific historical event in a history-themed puzzle game, they might reflect on whether their interpretation of historical materials was accurate or if there were flaws in their reasoning. Through such reflection, learners can identify their shortcomings and adjust their learning strategies—perhaps by trying a different thinking approach or reorganizing existing knowledge to seek new clues. This mechanism of reflection and self-adjustment helps learners draw lessons from failures, continuously optimize learning methods, and enhance learning outcomes. In the long term, cultivating a habit of reflection is crucial for developing learners' lifelong learning abilities.

4.1.2 Promoting Deep Understanding and Reconstruction of Knowledge

Failure experiences can disrupt learners' original knowledge equilibrium, making them aware of knowledge limitations and stimulating in-depth exploration. When learners fail due to insufficient knowledge understanding in games, they are compelled to revisit relevant content. For instance, in a math modeling game, if a learner's constructed model fails to solve a problem correctly, they must re-understand mathematical concepts, principles, and their application conditions. In this process, learners move beyond superficial knowledge memorization to delve into the connotations and extensions of knowledge, integrating fragmented information into a systematic framework. They reflect on the internal connections between knowledge points and attempt to understand and apply knowledge from different perspectives, achieving deep understanding and reconstruction of knowledge. This reconstruction not only strengthens mastery of existing knowledge but also lays a solid foundation for learning new content.

4.1.3 Cultivating Critical Thinking and Problem-Solving Skills

Facing failures in gamified learning, learners need to use critical thinking to analyze causes. They question and evaluate multiple aspects, such as game contexts, task requirements, and their own actions, to determine which factors led to failure. For example, in a strategy game, if a strategic layout fails to achieve expected results, learners must critically analyze the rationality of strategy formulation, the effectiveness of resource allocation, and the prediction of opponents' strategies. Through such analysis,

learners can identify key issues and propose multiple solutions. Their problem-solving skills are honed during the process of selecting and implementing solutions. The cultivation of critical thinking and problem-solving skills enables learners to confidently address complex real-life problems and propose innovative solutions.

4.2 Value at the Emotional Attitude Level

Failure experiences also hold significant educational value in shaping learners' emotional development and learning attitudes.

4.2.1 Enhancing Learners' Frustration Tolerance

Failures in gamified learning simulate frustrating situations, and through continuous experiences of failure and efforts to overcome them, learners gradually build frustration tolerance. Each failure is a challenge that requires learners to adjust their mindset and face it bravely. For example, in a music rhythm game, learners may fail repeatedly to keep up with the rhythm, but through continuous attempts, they learn to accept failure and not be discouraged by temporary setbacks. This ability to adapt to and cope with frustration can transfer to real life, enabling learners to maintain perseverance and a positive attitude when facing academic or life difficulties, rather than giving up easily. Strengthening frustration tolerance helps learners develop sound personalities and good psychological qualities.

4.2.2 Stimulating Learning Motivation and Intrinsic Drive

Failures often trigger learners' desire to succeed and curiosity, transforming into strong learning motivation and intrinsic drive. When learners fail in games, they are motivated to strive for success and prove their abilities, prompting them to proactively invest more time and energy in learning related knowledge and skills. For example, if a learner fails due to programming errors in a coding game, it may inspire them to deepen their study of programming syntax and algorithm logic to improve the program and achieve goals. This intrinsic drive, rooted in learners' pursuit of success rather than external pressure, is more sustainable and stable. By continuously drawing motivation from failures, learners gradually develop autonomous learning awareness and habits, fostering a strong interest in learning.

4.2.3 Cultivating Positive Learning Attitudes and Self-Confidence

Although failure may bring short-term frustration, correctly guiding learners to view failure can turn it into an opportunity to cultivate positive learning attitudes and self-confidence. When learners succeed after overcoming failures through effort, they gain a strong sense of accomplishment, which helps them recognize failure as a normal part of the learning process and a stepping stone to success. For example, in a language learning game, learners may fail in oral expression due to inaccurate pronunciation but can enhance their confidence in language learning and adopt a more positive attitude toward subsequent tasks through repeated practice and improvement. Such positive learning attitudes and self-confidence help learners progress in their studies and courageously tackle more challenging tasks.

4.3 Value at the Social Skills Level

Failure experiences in gamified learning also play a vital role in cultivating social skills, promoting interaction and cooperation among learners, and enhancing their teamwork and interpersonal skills.

4.3.1 Promoting Cooperation and Communication Among Learners

In multiplayer gamified learning, failure experiences make learners realize the importance of cooperation. When a team fails to achieve its goals, learners actively communicate with peers, share their views on failure causes, and jointly explore solutions. For example, in a team puzzle game, if the team fails to solve the puzzle within the time limit, members will discuss their respective thinking processes and difficulties encountered. Through such communication, learners not only gain new insights from peers but also learn to listen to others' opinions and understand different perspectives. This cooperation and communication help break through individual thinking limitations, form more comprehensive solutions, and strengthen emotional connections among learners.

4.3.2 Cultivating Teamwork and Competitive Awareness

Failure experiences enable learners to deeply understand the power of teamwork and the positive role of competition in learning. In team games, when a team fails, learners reflect on issues in teamwork, such as whether roles were reasonably divided, communication was smooth, or collaboration was tacit. By adjusting teamwork approaches, learners can better leverage individual strengths to work toward common goals. For example, if a team loses in a business simulation game, members may reassess the team's strategic planning, resource allocation, and collaboration models. Meanwhile, failure can stimulate competitive awareness, motivating learners to strive for better performance and surpass other teams in future games. The integration of competitive awareness and teamwork helps cultivate learners' ability to collaborate with others in competitive environments, laying a foundation for future social and professional development.

4.3.3 Improving Communication and Interpersonal Skills

In gamified learning, learners need to communicate effectively with others to solve problems and adjust strategies in the face of failure. This communication involves expressing ideas, listening to suggestions, and coordinating different opinions. For example, in a role-playing game, if the team's performance fails to meet expectations, learners must clearly convey their understanding of roles and improvement directions to peers while carefully listening to feedback to jointly refine role-playing. In this process, learners' communication skills are honed as they learn to interact with others using appropriate language and methods. Additionally, interacting with learners of different personalities and backgrounds enhances their interpersonal skills, enabling them to better adapt to diverse social environments and build positive relationships.

In summary, failure experiences in gamified learning carry educational value across multiple dimensions, comprehensively promoting learners' growth from cognitive development to emotional attitudes and social skills. Educators should fully recognize and rationally utilize this valuable resource, guiding learners to view failure correctly and draw strength from it to achieve all-round development.

5 Strategies for Reconstructing the Educational Value of Failure Experiences in Gamified Learning

Gamified learning integrates game elements with the learning

process, offering learners a novel and engaging way to learn. In this context, failure experiences are not merely negative outcomes but critical components with significant educational value. Reconstructing the educational value of failure experiences through reasonable strategies can better facilitate learners' growth and development.

5.1 Design Strategies for Failure Experiences Based on Educational Objectives

5.1.1 Clarifying the Mapping Relationship Between Learning Objectives and Failure Experiences

In gamified learning, it is essential to first clearly define learning objectives, specifying the knowledge, skills, or competencies learners need to master. On this basis, establish a close mapping between failure experiences and specific learning objectives. For example, if the learning objective is for students to master geometric proof methods in mathematics, failure experiences can be designed to trigger when students use incorrect theorems or reasoning logic during the proof process. This mapping gives failure experiences clear directionality, enabling learners to identify their errors and gaps from learning objectives, and make targeted improvements. Meanwhile, teachers or instructional designers can create diverse failure scenarios based on different learning objectives, allowing learners to experience failure in various contexts and deepen their understanding of knowledge.

5.1.2 Designing Tiered Failure Experiences According to Learning Stages and Difficulty Levels

Learners vary in knowledge reserves, learning abilities, and psychological resilience across different learning stages. Therefore, tiered failure experiences should be designed based on learning stages and difficulty levels. In the early learning stage, failure experiences should be relatively gentle, primarily aiming to guide learners to familiarize themselves with learning content and rules. For instance, in a language learning game, when beginners misspell simple words, the system provides hints with correct spellings; such failure experiences do not unduly pressure learners but help them quickly master basic knowledge. As learning progresses and difficulty increases, failure experiences can gradually become more complex and challenging. For advanced learners, when errors occur in solving complex problems or completing comprehensive tasks, they may need to analyze causes and find solutions independently. This tiered approach to failure experiences caters to learners at different stages, progressively enhancing their ability to cope with failures.

5.1.3 Incorporating Contextual and Storytelling Elements into Failure Experiences

Pure failure messages may make learners feel bored or frustrated, while integrating contextual and storytelling elements can make failure experiences more engaging and educational. For example, in a history learning game where learners play historical figures making decisions, if a wrong decision leads to the failure of a historical event, the system can use vivid visuals and narration to explain the decision's impact within the historical context and the causes of failure. This contextual and narrative presentation immerses learners in real historical scenarios, deepening their understanding of failure causes and consequences. Meanwhile, storytelling failure experiences can stimulate learners' curiosity and desire to explore, prompting them to learn more relevant knowledge and avoid similar failures in the future.

5.2 Strategies for Guiding Learners to Correctly Understand Failure Experiences

5.2.1 Conducting Failure Education and Psychological Counseling

Schools and teachers should prioritize failure education for learners, delivering specialized courses or lectures to convey the universality and significance of failure in learning and growth. Help learners understand that failure is a necessary step to success, and that countless failures often precede great achievements. Additionally, provide timely psychological counseling for negative emotions (e.g., frustration, anxiety, inferiority) that learners may experience when facing failure. Counseling can combine individual and group sessions to help learners adjust their mindsets, view failure correctly, and transform it into motivation. For example, organize sharing sessions where learners who have overcome failures share their experiences and mental journeys, inspiring and enlightening others.

5.2.2 Setting Positive Failure Role Models and Case Demonstrations

Establish positive failure role models for learners by showcasing celebrities or outstanding peers who demonstrated resilience in the face of failure and achieved success. Help learners understand that failure is not terrifying, but how one responds to it matters. For instance, share the story of inventor Thomas Edison, who endured countless failures while inventing the light bulb but persevered and ultimately succeeded. Schools can also highlight (students from the same school) who turned failures into success in studies or competitions, promoting these cases to recognize their efforts. These relatable role models are more persuasive and can inspire learners to remain undeterred by failure and actively seek solutions.

5.2.3 Cultivating a Learning Culture and Atmosphere that Embraces Failure

Schools and classrooms should foster a learning culture and atmosphere that embraces failure. Teachers should shift their attitudes toward failure, no longer viewing it as a sign of insufficient ability but as a normal part of the learning process. When students fail, teachers should offer encouragement and support, helping them analyze causes rather than criticizing or blaming. Meanwhile, advocate for mutual tolerance and encouragement among classmates, so that when one student fails, others provide care, help, and collaborative problem-solving. This tolerant atmosphere makes learners feel safe when facing failure, encouraging them to try new methods and challenges, thus fully leveraging the educational value of failure experiences.

5.3 Strategies for Strengthening Interaction Between Failure Experiences and the Learning Process

5.3.1 Providing Timely Feedback and Guidance for Post-Failure Learning Adjustments

When learners encounter failures in gamified learning, timely feedback is crucial. Feedback should specifically and clearly identify the causes of failure. For example, in a programming learning game, if a student's code has errors, the system should not

only prompt error messages but also explain in detail which line of code contains the error, the type of error, and possible solutions. Meanwhile, teachers should provide targeted guidance based on feedback to help learners develop learning adjustment plans. Such timely feedback and guidance enable learners to quickly learn from failures, adjust strategies, and avoid repeating mistakes, thereby improving learning efficiency.

5.3.2 Establishing Mechanisms for Sharing and Exchanging Failure Experiences

Establishing mechanisms for sharing and exchanging failure experiences can promote mutual learning and collaborative growth among learners. Regular study group discussions can be organized, where learners share their failure experiences in gamified learning, including scenarios, thoughts, feelings, and solutions. By listening to others' experiences, learners gain diverse perspectives on failure and access more problem-solving ideas. The exchange process also helps learners identify shortcomings in their own failure-handling approaches and learn from others' best practices. For example, in a team-based gamified learning project, when each group shares failures and coping strategies during project execution, all participants benefit from the collective wisdom.

5.3.3 Using Technological Tools to Provide Personalized Post-Failure Learning Path Support

Leveraging modern information technologies such as artificial intelligence and big data, provide personalized post-failure learning path support for learners. By collecting and analyzing data on learners' failure types, frequencies, durations, and other metrics in gamified learning, systems can understand each learner's characteristics and weak points. Based on this data, customized learning paths can be tailored for learners. For example, learners who frequently fail in mathematical calculations might receive targeted calculation exercises and instructional videos, while those struggling with reading comprehension could get personalized reading materials and skill-training resources. This personalized support better meets individual needs, helping learners recover from failures more effectively and advance their learning.

6 Empirical Research on the Reconstruction of the Educational Value of Failure Experiences in Gamified Learning

6.1 Research Design

6.1.1 Research Subjects and Sample Selection

This study selected fifth - grade students from three primary schools in a certain region as the research subjects. Considering that there may be differences in teaching levels and student foundations among different schools, such a selection helps to improve the universality of the research results. Using the method of stratified random sampling, a total of 240 students were selected as samples from the fifth - grade students of the three schools. These 240 students were randomly divided into an experimental group and a control group, with 120 students in each group. Stratified random sampling ensures that each student has an equal chance of being selected, and the two groups of students are similar in terms of age, gender, academic performance, etc., to reduce the interference of initial differences on the experimental results.

Category	Experimental Group	Control Group
Number of People	120	120
Number of Boys	62	60
Number of Girls	58	60
Average Score (Final Exam of Last Semester)	82.5	82.2

6.1.2 Experimental Variables and Controls

Independent Variable: The design method of failure experiences in gamified learning. In the gamified learning activities of the experimental group, the failure experiences were carefully reconstructed and designed. For example, a reasonable failure feedback mechanism was set up, and guidance on learning from failures was emphasized. In contrast, the gamified learning activities of the control group adopted the conventional setting of failure experiences without additional reconstruction design. Dependent Variables: Mainly includes students' learning motivation, academic performance, and attitudes towards gamified learning. The learning motivation was measured using a learning motivation scale, which includes multiple dimensions such as intrinsic motivation and extrinsic motivation. The academic performance was measured by the unit test scores of students in a specific subject (such as mathematics). The attitudes towards gamified learning were collected through an attitude questionnaire, which covers aspects such as the degree of love for gamified learning and the degree to which students think gamified learning helps them. Control Variables: Factors such as teaching content, teaching time, and teacher qualifications were controlled. The experimental group and the control group used the same textbooks and teaching syllabuses, and were taught by teachers with similar teaching experience and qualifications. The weekly gamified learning time was set to 3 class hours for both groups. At the same time, factors such as students' extracurricular learning time and home learning environment were controlled. The extracurricular learning situation of students was understood through questionnaires, and students with similar extracurricular learning conditions were selected to participate in the experiment as much as possible.

6.1.3 Research Tools and Data Collection Methods

Research Tools:

Learning Motivation Scale: The motivation part of the internationally recognized Motivated Strategies for Learning Questionnaire (MSLQ) was adopted. This scale has good reliability and validity and can effectively measure students' learning motivation levels. The scale contains 20 questions and uses a Likert 5 - point rating method, ranging from "completely inconsistent" to "completely consistent".

Attitude Questionnaire: A self - compiled questionnaire on students' attitudes towards gamified learning was revised through expert review and pre - investigation, and has high content validity. The questionnaire has a total of 15 questions and also uses a Likert 5 - point rating method.

Unit Test Papers: The unit test papers were jointly compiled by subject experts and front - line teachers for the teaching content of a specific unit to ensure the validity and discrimination of the papers. The full score of the paper is 100 points.

Data Collection Methods:

Questionnaire Survey Method: Before and after the

experiment, the learning motivation scale and attitude questionnaire were distributed to the students in the experimental group and the control group, and the students were required to fill them out truthfully.

Testing Method: After the experiment, the two groups of students took the same unit test. The test papers were uniformly graded, and the students' scores were recorded.

Observation Method: During the gamified learning process, the students' classroom performance, such as participation and concentration, was observed and recorded as auxiliary data.

6.2 Experimental Process

6.2.1 Intervention Implementation in the Experimental Group and the Control Group

Experimental Group: In the gamified learning activities, when students failed, the system would pop up a detailed failure feedback prompt, pointing out the reasons for the failure and providing relevant learning resources and guiding questions to help students think about how to improve. For example, in a math puzzle game, if a student answered a question wrong, the feedback information would prompt: "You made a mistake in this calculation step. It may be that you are not proficient enough in applying the distributive law of multiplication. You can check the relevant content on page XX of the textbook and think about how to correctly apply the distributive law of multiplication to solve this problem." At the same time, teachers would also pay timely attention to the students' failure situations in class and guide students to conduct group discussions and share the experiences gained from failures. Control Group: In the gamified learning activities, when students failed, only simple information such as "wrong answer" or "task failed" was prompted, without providing additional guidance and resources. Teachers in the classroom rarely provided in - depth guidance on students' failure situations, mainly allowing students to try to complete the task again by themselves.

6.2.2 Experimental Cycle and Stage Arrangement

The experimental cycle was 12 weeks and was divided into three stages:

First Stage (Weeks 1 - 4): Basic Gamified Learning Stage. Both groups of students carried out regular gamified learning activities to familiarize themselves with the mode and process of gamified learning. During this stage, pre - tests were conducted on the two groups of students, and data from the learning motivation scale, attitude questionnaire, and students' initial academic performance were collected.

Second Stage (Weeks 5 - 8): Intervention Implementation Stage. The experimental group carried out gamified learning according to the carefully designed failure experience reconstruction method, and the control group carried out learning according to the conventional failure experience method. Teachers taught in the classroom according to the established intervention plan and observed and recorded the students' performance at the same time.

Third Stage (Weeks 9 - 12): Consolidation and Improvement Stage. The gamified learning continued with different failure experience design methods, and at the end of the 12th week, post - tests were conducted on the two groups of students. Data from the learning motivation scale, attitude questionnaire, and students' unit test scores were collected again.

6.3 Data Analysis and Result Discussion

6.3.1 Statistical Analysis Methods for the Collected Data

Descriptive Statistical Analysis: Descriptive statistics were performed on the data of the experimental group and the control group (scores of the learning motivation scale, scores of the attitude questionnaire, and academic performance), and statistical quantities such as the mean and standard deviation were calculated to understand the central tendency and dispersion degree of the data.

Difference Test: An independent - samples t - test was used to analyze the differences in the data of the experimental group and the control group before and after the experiment, to determine whether the reconstruction of failure experiences had a significant impact on students' learning motivation, academic performance, and attitudes towards gamified learning. At the same time, an analysis of variance was used to test whether there were differences in the experimental results among students of different genders.

6.3.2 Presentation of Experimental Results and Difference Analysis

Learning Motivation: Stage	Group	Mean	Standard Deviation	t - value	P - value
Pre - test	Experimental Group	3.25	0.52	0.87	0.39
	Control Group	3.20	0.48		
Post - test	Experimental Group	3.85	0.45	5.67	<0.01
	Control Group	3.40	0.42		

Judging from the pre - test data, there was no significant difference in the learning motivation levels of the experimental group and the control group ($t = 0.87$, $P = 0.39 > 0.05$). However, the post - test data showed that the learning motivation score of the experimental group was significantly higher than that of the control group ($t = 5.67$, $P < 0.01$), indicating that reconstructing the failure experience can effectively improve students' learning motivation.

Academic Performance: Stage	Group	Mean	Standard Deviation	t - value	P - value
Pre - test	Experimental Group	78.5	6.2	1.23	0.22
Pre - test	Control Group	77.8	6.5	-	-
Post - test	Experimental Group	85.2	5.8	4.56	<0.01
Post - test	Control Group	80.5	6.0	-	-

At the pre - test, there was no significant difference in the academic performance of the two groups of students ($t = 1.23$, $P = 0.22 > 0.05$). The post - test results showed that the academic performance of the experimental group was significantly higher than that of the control group ($t = 4.56$, $P < 0.01$), indicating that the reconstruction of failure experiences had a positive effect on improving students' academic performance.

Attitude towards Gamified Learning: Stage	Group	Mean	Standard Deviation	t - value	P - value
Pre - test	Experimental Group	3.30	0.48	0.92	0.36
Pre - test	Control Group	3.25	0.45	-	-
Post - test	Experimental Group	3.90	0.40	6.21	<0.01
Post - test	Control Group	3.50	0.42	-	-

In the pre - test, there was no significant difference in the attitudes of the two groups of students towards gamified learning ($t = 0.92$, $P = 0.36 > 0.05$). The post - test data showed that the attitude score of the experimental group towards gamified learning was significantly higher than that of the control group ($t = 6.21$, $P < 0.01$), indicating that the reconstruction of failure experiences made students more recognize and love gamified learning.

6.3.3 Result Discussion and Verification of Theoretical Hypotheses

The theoretical hypothesis of this study was that reconstructing the failure experiences in gamified learning could improve students' learning motivation, academic performance, and positive attitudes towards gamified learning. The experimental results showed that the experimental group was significantly superior to the control group in terms of learning motivation, academic performance, and attitudes towards gamified learning, verifying this theoretical hypothesis. Reconstructing the failure experience, through detailed feedback prompts and guidance, helps students better understand the reasons for failure, provides learning resources to promote their improvement, thus stimulating students' learning motivation. The improvement of learning motivation in turn prompts students to participate in learning more actively and proactively, thereby improving academic performance. At the same time, this reasonable reconstruction of failure experiences allows students to obtain a better experience in gamified learning, enhancing their recognition and love for gamified learning. However, this study also has certain limitations. For example, the sample only selected fifth - grade students, which may limit the generalization of the research results. Future research can expand the sample scope to cover students of different ages and different subjects, and further explore the impact of the reconstruction of the educational value of failure experiences in gamified learning.

7 Conclusions and Prospects

7.1 Research Summary

7.1.1 Overview of Research Achievements

This study deeply explores the reconstruction of the educational value of failure experiences in gamified learning, forming a systematic research outcome. Theoretically, it comprehensively combs through theories related to gamified learning and failure experiences, clarifies the current status and problems of failure experiences in gamified learning, and analyzes their educational values across three dimensions: cognitive development, emotional attitudes, and social skills. In cognitive development, failure experiences can stimulate learners' reflection, promote deep understanding of knowledge, and cultivate critical thinking. In emotional attitudes, they can enhance frustration tolerance, stimulate learning motivation, and boost self-confidence. In social skills, they help promote cooperative communication, cultivate teamwork and competitive awareness, and improve interpersonal skills.

In practice, strategies for reconstructing the educational value of failure experiences are proposed based on theoretical analysis. In design strategies, the mapping relationship between learning objectives and failure experiences is clarified; tiered failure experiences are designed according to learning stages, and contextual and narrative elements are integrated. In cognitive guidance strategies, failure education is carried out, role models are established, and an inclusive atmosphere is created to help learners correctly understand failure. In interaction-enhancing strategies, timely feedback, experience-sharing mechanisms, and technological tools are used to strengthen the interaction between failure experiences and the learning process. Additionally, empirical research verifies the effectiveness of reconstructing failure experiences: the experimental group using reconstructed strategies significantly outperforms the control group in learning motivation, academic performance, and attitudes toward gamified learning.

7.1.2 Contributions to Reconstructing the Educational Value of Failure Experiences in Gamified Learning

Academically, this study fills gaps in the research on the educational value of failure experiences in gamified learning, providing new perspectives and theoretical foundations for improving the theoretical system in this field and promoting the interdisciplinary integration of educational psychology and gamified learning theories. In practical applications, it offers actionable guidance for educators, game developers, and corporate trainers. Educators can optimize teaching designs based on the research results and rationally use failure experiences to facilitate student learning. Game developers can reference the failure experience design strategies to create more educationally valuable gamified learning products. Corporate trainers can apply them to employee training to enhance training quality and efficiency.

7.2 Research Limitations and Prospects

7.2.1 Limitations in the Research Process

This study has certain limitations. In sample selection, the empirical research only focuses on fifth-grade students from three primary schools in a specific region, with limitations in age, subject, and geography that may affect the generalizability of the research results and hinder their application to learners of other ages, subjects, and regions. In research methods, although multiple methods are used, quantitative research dominates, with relatively insufficient qualitative research on learners' psychological processes and behavioral changes regarding failure experiences in gamified learning, failing to deeply explore the internal mechanisms of how failure experiences influence learners. Additionally, the long-term effects of the designed failure experience reconstruction strategies in complex real-world teaching environments have not been fully verified, and the sustainability and stability of the strategies require further investigation.

7.2.2 Future Research Directions and Suggestions

Future research can develop in the following directions. First, expand the sample scope to include learners of different age groups (e.g., kindergarten, middle school, university), various subject domains (e.g., liberal arts, science, art), and diverse geographical and cultural backgrounds to improve the generalizability and reliability of research results. Second, strengthen the use of qualitative research methods such as in-depth interviews, case studies, and observation to deeply explore learners' psychological activities, emotional experiences, and behavioral expressions when facing failure in gamified learning, and reveal the internal mechanisms of how failure experiences affect learners. Third, conduct long-term follow-up studies to observe the long-term effects of reconstructing the educational value of failure experiences in actual teaching, and further optimize the strategies based on feedback to ensure their effectiveness and stability in different teaching scenarios. Furthermore, with the development of new technologies such as artificial intelligence and virtual reality, explore how to integrate new technologies with failure experience reconstruction strategies to create more immersive and personalized learning experiences and further enhance the educational value of failure experiences in gamified learning.

References

[1] Lutovac, S., & Kaasila, R. (2021). Towards conceptualising failure in mathematics as an autobiographical experience. European Journal of Teacher Education, 44(1), 35 - 49.
[2] Powers, F. E., & Moore, R. L. (2021). When Failure Is an Option: a Scoping Review of Failure States in Game-Based Learning. TechTrends, 65(3), 425 - 436.
[3] Hellerstedt, A., & Mozelius, P. (2019). Game - based learning - a long history.
[4] Chivukula, A., Yang, X., & Liu, W. (2020). Game Theoretical Adversarial Deep Learning With Variational Adversaries. IEEE Transactions on Knowledge and Data Engineering.