Asia Pacific Science Press

Journal of Educational Theory and Practice
ISSN(O):3005-9313
ISSN(P):3005-9305
Vol. 3 No.2 (2026)

Theoretical Analysis of Gamified Music Application for Cultivating Intrinsic Motivation in Music Education

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Abstract: The present study explores the traditional music teaching method known as instrumental music teaching and discusses the drawbacks related to the repetitive nature of training and the lack of prompt feedback. Beginner students who learn how to play musical instruments like piano and flute usually have trouble overcoming their struggles while studying music, resulting in higher rates of music course dropouts. In order to solve this problem, the study creates a model for music teaching methodology, using the concept of game elements that comes from an extensive literature review. The theoretical background is based on the Self-Determination and Flow theories. There are four main dimensions in the model, including: 1) student learning profiles; 2) step-by-step resource allocation; 3) individual-based teaching process; 4) multidimensional evaluation process. The goal of the study is to create an effective approach to motivating learners intrinsically. Additionally, the study offers an outlook on the future development of collaboration between humans and machines in the field of music.

Keywords: Intrinsic Motivation; Music Education Gamification ;Teaching Flow; Theory Teaching Model

Published: May 13, 2026

DOI: https://doi.org/10.62177/jetp.v3i2.1353

1. Introduction

1.1 Background and Challenges of Music Education

Music education is a unique and complex field. Instrumental performance training is highly professional, requiring learners not only to combine motor skills with auditory perception, but also to incorporate artistic expressiveness into the technique. But there are obvious drawbacks in the traditional standardized teaching methods. For example, the uniform teaching model has become difficult to adapt to the diverse needs of contemporary students, who show great diversity in cognitive style and learning progress. The advancement of digital technology has brought new possibilities to overcome these limitations, and the education sector has begun to apply gamified design elements to music education. A number of empirical studies have shown that this is an effective intervention. Gamification design can significantly boost students' enthusiasm, and this approach can transform dull mechanical practice into meaningful artistic exploration activities.

1.2 Core Contradictions in Traditional Practice

An analysis of the practice methods of traditional Musical Instruments reveals that there are two fundamental contradictions that can undermine students' enthusiasm for learning and learning outcomes. The first contradiction is the polarization of associative motivation caused by mechanical repetition. Traditional training relies too much on scale and arpeggio practice, which is seriously lacking in the actual musical context. Therefore, prolonged meaningless repetition significantly reduces

students' motivation for autonomous learning [1] and leads to a state of no motivation due to the lack of varied practice. As a result, students subjectively feel that their efforts have nothing to do with the actual musical outcome. Students with weak interest are prone to giving up halfway; The second contradiction is the serious lack of real-time feedback mechanisms. Traditional teaching is highly dependent on offline classes once a week, and students lack professional technical guidance during long periods of self-practice. Delayed feedback directly weakens students' sense of self-efficacy and leads them to repeat mistakes without realizing it. It is also prone to forming extremely difficult-to-correct incorrect muscle memory [2].

1.3 Research Objectives

This study builds a framework of gamified music education theory in response to the core contradictions existing in traditional instrumental teaching, relying on digital technology to achieve four optimization goals: First, to transform mechanical practice into meaningful goal-oriented activities to stimulate students' intrinsic learning motivation; The second is to provide immediate and targeted feedback to help improve performance skills; The third is to build personalized learning paths that are tailored to individual differences in students' skill levels, interests, and learning styles; The fourth is to enhance learning efficiency through technology while retaining the humanistic essence at the core of music education. The framework combines self-determination theory with flow theory to form a teaching model supported by psychological theory, which can effectively address the technical training and learning motivation challenges currently faced by music education.

2. Literature Review

2.1 Advances in Personalized Teaching Research

Personalized learning has become a mainstream trend in educational research over the past decade, and adaptive systems for personalized learning have demonstrated remarkable effectiveness in the field of education [3]. Intelligent systems also show great potential in music education. These systems can precisely adjust the teaching difficulty through underlying algorithms, and can intelligently match music types and adjust practice schedules. This mechanism successfully creates highly personalized learning experiences [4]. Automatic chord recognition technology has made technological breakthroughs in recent years, and artificial intelligence means such as automatic music transcription have become increasingly mature. These cutting-edge technologies can effectively integrate dull technical training with students' real musical interests and effectively improve the disconnection between traditional instrumental teaching.

2.2 The Special Nature of Music Education

Learning music faces two challenges: a long cycle and great psychological stress [1]. First of all, music learning is highly dependent on psychomotor skills and requires long-term and repeated practice. Problems such as long learning cycles, stage anxiety, and external pressure keep emerging, which increases the difficulty of instrumental learning. Secondly, music learning requires both technical precision and artistic expressiveness. Traditional teaching is difficult to balance the cultivation of both. A single basic skill training cannot support the emotional expression of music, and the lack of technical foundation will also limit the artistic performance of students. Finally, music has distinct social and cultural attributes, and its value is realized through cultural consensus and interpersonal interaction, which greatly increases the difficulty of designing personalized music teaching systems, requiring intelligent teaching models to adapt to individual learning differences while taking into account students' cooperation and communication as well as group music experience.

2.3 The Underlying Support of Self-Determination Theory and Flow Theory

Desi and Ryan put forward the famous self-determination theory, which holds that the maintenance of intrinsic motivation depends on the continuous satisfaction of three fundamental psychological needs: autonomy, competence, and relevance. Numerous studies in music education have confirmed that satisfying students' autonomous choice,

ability experience, and social connection can effectively maintain the motivation to learn music. In technology-assisted learning Settings, providing meaningful choices can greatly satisfy students' autonomy [5], and moderate system challenges and immediate feedback can significantly enhance learners' competence [6]. The introduction of a social identity perspective is also indispensable, which helps to meet the learner's need for social relevance, and this emotional level of satisfaction is key to maintaining the motivation for continuous practice [7,2].

Zickson-mihaly proposed the theory of flow. Flow states arise from the perfect dynamic balance of challenge difficulty and

individual skills. Research shows that meeting basic psychological needs helps trigger flow experiences in digital learning [8], and in music teaching, optimizing the balance of challenge and skills can significantly increase classroom engagement [9]. Interactive systems can actively stimulate the learner's flow state through algorithms, which can effectively regulate the positive relationship between technology application and learning efficiency [10]. The deep integration of self-determination theory and flow theory is of great academic value, providing a solid foundation for gamified instructional design that takes into account both motivation stimulation and experience optimization [11].

The two theories complement each other and are highly compatible, and the satisfaction of psychological needs can promote the generation of the state of flow. The integration of the two can provide design criteria for gamified instrumental music teaching: ensuring students' sense of achievement through appropriate task difficulty, satisfying students' autonomy needs through diverse learning, continuously motivating learning through progress feedback, and strengthening emotional connections through musical social interaction, thereby constructing a modern instrumental music teaching model that is both interesting and effective.

3. Systemic Problems in Traditional Music Performance Training

3.1 A Serious Disconnection between Theory and Practice

Traditional teaching strictly separates basic training from artistic practice, and for a long time separates basic skills practice from real musical experience. Students have long engaged in mechanical training such as scales and fingerings, but have difficulty establishing a connection between technical practice and musical performance and musical expression. From beginner, intermediate to advanced stages, traditional teaching has the drawback of emphasizing technical refinement and neglecting musical application and artistic expression. This disjointed learning model is very likely to weaken students' initial learning motivation and reduce their intrinsic enthusiasm for continuous practice.

3.2 Rigid and Monotonous Teaching Methods

Traditional instrumental teaching often adopts a rigid model where teachers demonstrate and students imitate and practice. Although it can help students master basic playing skills, it limits the space for students' independent exploration and innovation, making it difficult to achieve individualized teaching. Innovative methods such as gamified learning and mobile learning can break this single structure. The introduction of multi-dimensional interactive experiences can stimulate interest while ensuring the rigor of basic teaching, making up for the deficiencies of traditional teaching [12].

3.3 Extreme Imbalance in Student Engagement

The combination of dull practice and lagging feedback leads to learned helplessness, a phenomenon that gradually causes students to lose motivation to learn and eventually drop out of instrumental learning. Although professional musicians can fully meet the psychological development needs, the music learning process itself is highly difficult, which greatly hinders the psychological needs of students during the learning process. Therefore, many potential learners encounter a bottleneck period before mastering sufficient skills, and they often give up music learning completely due to intense frustration [1].

3.4 Result-oriented Evaluation of Alienation

In the traditional music teaching evaluation process, due to an excessive focus on final outcome assessments such as performances and competitions, the dynamic learning growth process of students is overlooked. This result-oriented evaluation model is prone to many problems: it makes students overly dependent on external learning motivation, one-sidedly pursue grades and rankings, and neglect understanding and aesthetic experience of music itself; There is a risk aversion mentality in fostering learning, and they are reluctant to explore music and express themselves creatively out of fear of negative evaluation; At the same time, the feedback from the summative assessment is monotonous and lagging, making it difficult to guide students to optimize their process-oriented abilities. Educators should incorporate gamification elements into the basic assessment system. Methods such as progress tracking and achievement unlocking can effectively shift attention from external outcomes to the internal learning process [13] to make up for the shortcomings of the traditional outcome-based evaluation approach.

4. Construction of an Engaging Teaching Model based on theory of Mind

This study builds a four-dimensional gamified music teaching framework based on the aforementioned theory.

4.1 Draw a Precise Student Learning Profile

Precise personalized teaching must begin with a deep understanding of the learner. The system can divide students into three categories based on the assessment of the initial data: the first category is the robust students, who are well-suited for progressive challenges, while the system focuses on tracking learning progress and recognizing their achievements for the robust students; The second category of growth-oriented students, who have a solid foundation, requires the system to provide them with diverse musical styles and exploratory experiences; The third category of breakthrough students, who are skilled in technology, requires the system to provide them with creative tasks that can challenge their limits, and a deep learning-based path planning model can automate and dynamically complete this complex profiling evaluation process [14].

4.2 Establish a Stepwise Resource Push Mechanism

The basic-level module combines interactive tutorials with immediate audio-visual feedback, which can effectively reduce the cognitive load of beginners and build initial competence [15]. The advanced modules incorporate historical narratives and listening contrast tasks, which help deepen students' understanding of specific musical styles. The challenge module introduces virtual performance simulation and free arrangement projects, and reinforcement learning algorithms can dynamically adjust the resource difficulty of the score in this section [16].

4.3 Design Personalized Interaction Processes

Digital instruments and artificial intelligence technologies such as twin residual neural networks can build immediate feedback loops [17]. The system provides millisecond-level precision feedback on pitch and rhythm, and even calculates and feeds back subtle emotional dynamics, fundamentally eliminating the formation of incorrect playing habits, while using story-telling scenarios and progressive unlocking mechanisms to build meaningful play experiences. The addition of the social leaderboard transforms repetitive practice into intrinsic value-driven behavior, significantly improving students' daily practice habits [18].

4.4 Build a Multi-Dimensional Dynamic Evaluation System

Single-dimensional performance indicators have obvious limitations. Gamification teaching must rely on a multi-dimensional evaluation matrix [19], which covers four core data metrics. The system assesses students' perseverance through practice duration and regularity, and uses progress rate to measure individual longitudinal growth to make up for the lack of traditional technical evaluation by extracting indicators of emotional expression, and also requires comprehensive collaboration and creative engagement to reflect the indispensable social attributes of music.

5. The Role of Human Educators and Technological Limitations

5.1 Embodied Cognition and Human Guidance are Irreplaceable

Music cognition is essentially an embodied practice that involves deep interaction between the mind and the body and the environment [20,21]. There are huge perceptual blind spots in relying solely on digital technology. For example, AI systems can accurately determine the right and wrong of acoustic frequencies [8], but algorithms cannot guide physical ergonomic skills such as arm weight fall and breathing coordination, and machines cannot replace the emotional resonance and cultural insight provided by human mentors when overcoming stage anxiety.

5.2 Building a Hybrid Human-Machine Collaboration Model

Future music education should move towards a hybrid and collaborative approach. Digital systems should serve as the underlying support scaffolding, while algorithms are responsible for high-frequency regular skills assessment and practice progress tracking. The system can also handle the gamification of dull exercises, freeing human educators from the cumbersome mechanical correction, allowing teachers to focus all their energy on embodied physical instruction, and thus mentors can devote more time to deep artistic aesthetic inspiration and psychological emotional support.

5.3 Ethical Considerations of Gamification Technology

Gamification design must be wary of potential manipulation risks. Platform developers must not only avoid exploiting psychological weaknesses to overly pursue system data engagement, but also handle sensitive data privacy at the underlying logic level. Gamified instructional design can induce three types of problems: the first is manipulation risk, a game

mechanism that partially promotes participation, which is prone to exploiting learners' psychological weaknesses to induce engagement rather than driving learning based on intrinsic interests; The second is privacy risk. The teaching system's meticulous tracking of students' learning behavior can lead to data security and privacy leakage risks. The third is the risk of educational equity. If gamified intelligent teaching resources are only available in quality institutions, it will further widen the gap in educational resources and exacerbate educational injustice [22].

6. Conclusion

The four-dimensional gamification framework proposed in this study systematically addresses the core pain points in traditional instrumental teaching. The model breaks the deadlock through the deep integration of technological empowerment and psychological mechanisms, and maintains intrinsic motivation in the teaching framework at the initial stage. This intervention approach completely breaks down the traditional barriers between technical training and artistic perception. Looking to the future, the multimodal assessment system, combined with artificial intelligence adaptive generation technology, will further enhance the dimension of music education, and through the introduction of virtual reality immersive social environments, it can also demonstrate broad educational prospects. Adhering to the people-oriented, human-machine collaborative educational philosophy is the key to the future development of the system, and the scientific and reasonable use of gamification technology will surely enable more learners to understand the deep essence of music in a fun exploration.

Funding

No

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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