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The Effect of Gamification in Physical Education on Motivational Indicators and Perceived Competence among Lower Secondary School Students

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A B S T R A C T

Objective: The present study aimed to investigate the effect of gamification-based physical education on motivational indicators and perceived competence among female lower secondary school students.

Methods and Materials: This quasi-experimental study employed a pretest–posttest design with an experimental and a control group. The statistical population consisted of seventh-grade female students enrolled in schools in Tabriz, Iran. Using convenience sampling, two intact classes were selected from one school and then randomly assigned to the experimental group (n = 31) and the control group (n = 25). The experimental group participated in eight 90-minute basketball instructional sessions designed according to gamification principles, whereas the control group received the same basketball content through conventional physical education instruction. Data were collected using the Perceived Competence Questionnaire and the Self-Regulation Questionnaire in Physical Education developed by Goudas et al. (1994). The collected data were analyzed using repeated-measures analysis of variance in SPSS software to examine changes over time and differences between the two instructional conditions.

Findings: Inferential analyses indicated that gamification produced a significant reduction in external regulation compared with traditional instruction. However, no statistically significant between-group differences were observed for intrinsic motivation, identified regulation, introjected regulation, or amotivation. The results also demonstrated a significant improvement in perceived competence among students exposed to the gamified instructional approach, whereas the traditional instructional condition did not produce a comparable improvement. Overall, the inferential findings suggest that gamification exerted selective effects on students' motivational regulation while producing a more evident positive effect on perceived competence.

Conclusion: Gamification appears to be a potentially effective instructional approach for enhancing perceived competence and reducing externally regulated motivation in physical education among female lower secondary school students. Nevertheless, its effects may not extend equally to all dimensions of motivational regulation. Accordingly, incorporating appropriately designed game elements into physical education may contribute to creating more competence-supportive and autonomously engaging learning environments.

Keywords: *Gamification; Physical Education; Motivation; Perceived Competence; Self-Regulation; Lower Secondary School Students*

1. Introduction

Physical education is an important component of the school curriculum because it contributes not only to the development of motor skills and physical fitness but also to students' psychological, motivational, social, and behavioral development. During early adolescence, participation in physical education may play a particularly important role because students are undergoing substantial physical, cognitive, emotional, and social changes that can influence their attitudes toward movement, exercise, and sport. The quality of students' experiences in physical education classes can therefore affect whether they perceive physical activity as enjoyable, meaningful, and personally valuable or, conversely, as externally imposed and disconnected from their interests. Motivation is especially important in this context because it influences effort, persistence, engagement, learning, and the intention to remain physically active beyond compulsory school settings. Research on physical education has consistently indicated that motivational processes are closely associated with the quality of students' participation and their subsequent behavioral intentions, while motivational difficulties may contribute to disengagement and reduced willingness to continue sport and physical activity (Behzadnia, Mollaei Zangi, et al., 2024; Martín-Moya et al., 2018). Accordingly, contemporary physical education increasingly emphasizes instructional approaches that can foster meaningful participation, enhance perceived competence, and support more autonomous forms of motivation rather than relying predominantly on teacher control, external rewards, or repetitive skill practice.

One of the most influential frameworks for understanding motivation in educational and physical activity settings is self-determination theory. From this perspective, motivation is not conceptualized simply in terms of its quantity but also in terms of its quality. Individuals may engage in an activity because they find it inherently enjoyable and satisfying, because they personally value its outcomes, because they experience internal pressure or obligation, because they expect external rewards or wish to avoid punishment, or because they lack sufficient intention to act. These forms of behavioral regulation can be positioned along a continuum ranging from relatively autonomous to relatively controlled motivation (Ryan & Deci, 2020). Intrinsic motivation represents engagement driven by inherent interest and enjoyment, while identified regulation occurs when individuals consciously recognize and accept the personal importance of an activity. Introjected regulation reflects behavior driven by internal contingencies such as guilt, pride, or pressure, whereas external regulation is characterized by behavior controlled by external rewards, demands, evaluation, or punishment. Amotivation refers to a state in which individuals perceive little connection between their actions and meaningful outcomes. Within physical education, more autonomous forms of motivation have generally been associated with stronger engagement, effort, persistence, well-being, and future physical activity intentions, whereas controlled motivation and amotivation tend to be associated with less adaptive outcomes (Vasconcellos et al., 2020). These distinctions are highly relevant when evaluating instructional strategies because a teaching method may increase participation without necessarily improving the underlying quality of students' motivation.

Self-determination theory further proposes that the satisfaction of the basic psychological needs for autonomy, competence, and relatedness is central to the development of high-quality motivation. Autonomy refers to experiencing a sense of volition and personal ownership over one's behavior, competence concerns feeling capable and effective when interacting with the environment, and relatedness reflects feelings of connection and belonging with others. In physical education, teaching strategies that support these needs may facilitate more adaptive motivational regulation and more positive affective and behavioral outcomes. Evidence from physical education contexts indicates that need-supportive teaching can enhance motivational quality

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and student engagement, including among populations that may experience particular challenges in traditional instructional environments (Behzadnia et al., 2022). Longitudinal evidence has likewise demonstrated that the extent to which physical education environments support students' psychological needs is related to subsequent motivation and well-being (Behzadnia, Fazeli, et al., 2024). These findings imply that effective instructional design should move beyond simple content delivery and should instead create learning environments in which students can experience choice, achievable challenge, meaningful progress, social connection, and a sense of mastery.

Among these psychological needs, perceived competence is especially salient in physical education because students are frequently required to perform observable motor tasks in front of peers, compare their abilities with classmates, and respond to success or failure in real time. Perceived competence refers to individuals' subjective evaluation of their capacity to perform successfully within a specific domain. In school physical education, students who believe that they are capable of learning and executing physical skills are more likely to approach tasks confidently, persist when difficulties arise, and interpret practice as an opportunity for improvement. By contrast, students who perceive themselves as incompetent may avoid participation, reduce effort, or experience embarrassment and anxiety. The measurement and psychometric evaluation of perceived motor competence have therefore received growing attention in developmental and educational research (Ramezanzadeh et al., 2021). Contextualized instruction can also influence perceived competence. For example, adapting learning experiences to students' interests and personal characteristics has been shown to improve situational interest and perceived competence in physical education (Roure & Pasco, 2022). Thus, perceived competence represents both a meaningful educational outcome and a potential mechanism through which instructional design can influence students' broader motivation toward physical activity.

Despite the theoretical importance of autonomous motivation and competence-supportive teaching, conventional physical education instruction often remains teacher-directed and skill-centered. Traditional skill-acquisition approaches may be effective for organizing practice and transmitting technical information, but they may not consistently provide sufficient opportunities for meaningful choice, immediate progress feedback, social collaboration, narrative engagement, or differentiated challenge. This can be particularly relevant during early adolescence, when students' interests are becoming more individualized and when monotonous or excessively controlled learning environments may weaken engagement. Consequently, researchers and practitioners have increasingly explored gamification as a strategy for redesigning educational experiences in ways that preserve curricular content while altering the motivational architecture through which that content is experienced.

Gamification generally refers to the intentional use of game-design elements and game-like structures in non-game contexts. In educational settings, these elements may include points, levels, badges, challenges, missions, avatars, storytelling, progress indicators, leaderboards, teams, rewards, immediate feedback, and opportunities to unlock new content. Gamification is not synonymous with simply playing games; rather, it involves redesigning the learning process so that ordinary instructional tasks are embedded within a more engaging system of goals, feedback, progression, and participation. Recent developments have expanded the application of gamification through interactive technologies and artificial intelligence, demonstrating its growing relevance as an educational design strategy for enhancing student engagement (Banik & Gullapelly, 2025). Gamified approaches have also been increasingly applied in virtual and technology-mediated education, where they may contribute to creative thinking, research-oriented engagement, and active participation (Shafiei Sarvestani et al., 2025). Similarly, evidence outside physical education has shown that gamification can positively influence students' motivation in academic learning environments, suggesting that its motivational mechanisms may generalize across educational domains (Diana et al., 2025).

Physical education is particularly well suited to gamification because its instructional content already involves goals, performance feedback, progression, competition, cooperation, and skill mastery. Gamification can organize these naturally game-like features into a coherent pedagogical framework while allowing teachers to emphasize learning rather than competition alone. Early research on gamification in physical education suggested that this approach was both feasible and positively perceived by students and teachers, highlighting its potential for strengthening engagement while preserving educational objectives (Fernandez-Rio et al., 2020). Experimental and quasi-experimental studies have subsequently examined a range of outcomes, including motivation, academic performance, physical activity, psychological responses,

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healthy habits, social interaction, and motor learning. In higher education, gamification has been associated with improvements in motivation and academic performance in physical education contexts (Ferriz-Valero et al., 2020), while sports gamification has also been linked to enhanced learning motivation and performance among university students (Liu & Lipowski, 2021). More recent evidence indicates that gamified physical activity environments can also influence motivation and objectively recorded physical activity behavior, although the magnitude and durability of these effects may vary according to intervention design (Grech et al., 2024).

The motivational effects of gamification may be particularly meaningful when game elements are designed to support psychological needs rather than simply increase external rewards. A well-designed gamified environment may support competence by providing clear goals, progressive levels, achievable challenges, visible progress, and immediate feedback. It may support autonomy when students are allowed to choose tasks, characters, roles, or pathways through the learning environment. It may support relatedness through teamwork, shared missions, mutual assistance, and cooperative objectives. Accordingly, gamification may improve not only the immediate attractiveness of a lesson but also the way in which students regulate their participation. A gamified intervention in physical education has been shown to influence basic psychological need satisfaction, motivation, and intention to be physically active, supporting the proposition that gamification may affect deeper motivational processes rather than surface-level enjoyment alone (Fernandez-Rio et al., 2022). Evidence from secondary school physical education further indicates that gamification can positively affect motivation and basic psychological needs, reinforcing its relevance for adolescent populations (Sotos-Martínez et al., 2024). However, these effects should not be assumed to occur uniformly across all motivational dimensions, because different game elements may simultaneously promote autonomy in some students while functioning as external controlling incentives for others.

This distinction is important because some common gamification features, particularly points and rewards, could theoretically increase externally regulated behavior if students become focused primarily on earning rewards or avoiding losses. From a self-determination theory perspective, the motivational value of gamification therefore depends heavily on how game mechanics are implemented. Competitive ranking systems, for example, may increase pressure for some students, whereas cooperative challenges, personalized progression, meaningful choice, and competence-oriented feedback may support more autonomous motivation. Recent research with university students participating in gamified physical activity has shown that motivational responses can be shaped by the structure of the gamified experience itself (Sotos-Martinez et al., 2024). This suggests that researchers should examine specific motivational regulations separately rather than relying exclusively on global motivation scores. Such differentiation is especially necessary when studying external regulation because a well-designed gamified intervention may paradoxically use visible game components such as points and levels while simultaneously reducing students' reliance on external control by making participation more meaningful, self-directed, and competence enhancing.

A growing body of research supports the educational potential of gamification in physical education, but findings remain heterogeneous across age groups, settings, outcomes, and intervention formats. Studies involving primary school students have demonstrated that gamified approaches combined with physical activity can improve classroom climate and social interaction (Dólera-Montoya et al., 2021). Gamified didactics using exergames have also produced meaningful psychological outcomes in primary physical education (Quintas et al., 2020), while qualitative evidence has highlighted the practical applicability, usability, and perceived educational value of gamified exergame-based instruction in school settings (Quintas-Hijós et al., 2020). Hybrid pedagogical approaches combining gamification with responsibility-oriented models have likewise been associated with beneficial motivational and healthy-behavior outcomes (Melero-Canas et al., 2021). These findings indicate that gamification can operate through multiple pathways, including increased enjoyment, clearer goals, stronger peer interaction, personalized progression, and heightened investment in learning tasks.

Evidence also suggests that gamification may produce benefits beyond motivation itself. Wibowo reported improvements in self-esteem, satisfaction, and motor skills following gamified elementary physical education, illustrating the potential breadth of psychological and motor outcomes influenced by this approach (Wibowo, 2024). Gamified physical activity interventions have also been tested among younger children, with pilot evidence indicating possible effects on both physical and cognitive outcomes (Davies et al., 2024). These studies are important

because they suggest that gamification may create a richer learning environment in which physical, cognitive, emotional, and motivational development interact. Nevertheless, age remains a critical consideration. Findings obtained in university students, young children, or primary school populations cannot automatically be generalized to lower secondary school students, whose developmental needs, peer dynamics, self-consciousness, and motivational profiles may differ substantially.

In addition, studies of motivation in physical education emphasize the importance of valid measurement when evaluating the psychological effects of interventions. Motivational self-regulation is multidimensional, and the psychometric quality of instruments used to distinguish intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation is essential for accurate interpretation. Research examining the factor structure of motivational self-regulation measures in physical education has supported the use of multidimensional assessment rather than treating motivation as a single undifferentiated construct (Behzadnia et al., 2018). Moreover, motivational regulations have practical consequences extending beyond the classroom, as they are associated with intentions to continue sport participation, including in populations facing barriers such as sport-related injury (Behzadnia, Mollaei Zangi, et al., 2024). These considerations reinforce the need to examine whether gamification changes particular forms of regulation rather than merely increasing general enthusiasm.

Despite substantial growth in the gamification literature, several gaps remain. First, a considerable portion of existing research has focused on university students, primary school students, exergame environments, or technology-assisted interventions, whereas fewer controlled studies have examined curriculum-based gamification among lower secondary school girls. Second, although motivation has frequently been assessed as an outcome, fewer studies have simultaneously examined distinct motivational regulations and domain-specific perceived competence. Third, many gamified interventions incorporate multiple interacting elements, making it difficult to determine whether observed motivational effects reflect competition, rewards, narrative immersion, social cooperation, progressive challenge, choice, feedback, or some combination of these mechanisms. Fourth, cultural and educational context may influence students' responses to gamification. Findings obtained in one national or institutional setting may not be directly transferable to another, particularly where physical education curricula, teacher practices, gender arrangements, and school norms differ. For this reason, evaluating gamification within Iranian school physical education can contribute context-specific evidence while also extending the international literature.

Another important issue concerns the distinction between engagement and motivational internalization. Gamification may attract students' attention and increase short-term participation, but educationally meaningful implementation should ideally reduce dependence on external control and foster a stronger sense of competence and self-directed participation. This distinction is consistent with evidence that supportive learning environments are associated with more adaptive motivational experiences in physical education (Behzadnia, Fazeli, et al., 2024; Behzadnia et al., 2022). It is also compatible with the broader self-determination framework, which emphasizes that the source and quality of motivation are central to sustained engagement (Ryan & Deci, 2020). Accordingly, investigating both motivational regulation and perceived competence can provide a more nuanced understanding of how gamification operates. If gamification increases perceived competence while reducing external regulation, it may indicate that students are becoming more confident and less dependent on externally imposed reasons for participation, even if changes in intrinsic motivation or other regulatory dimensions are modest.

The design of the gamified learning environment is therefore crucial. Narratives can provide meaning and continuity, team structures can strengthen relatedness, avatars can support identity and personalization, progressive levels can make improvement visible, and challenges can create optimal difficulty. Immediate feedback can clarify expectations and strengthen perceptions of mastery, while opportunities to choose characters or tasks may enhance autonomy. At the same time, team-based cooperation can shift students' attention away from interpersonal comparison and toward collective problem solving. These features are particularly relevant in basketball instruction, where skill acquisition naturally lends itself to progressive challenges involving dribbling, passing, coordination, decision-making, and teamwork. By embedding these tasks within a gamified narrative rather than changing the curriculum itself, it becomes possible to compare the motivational effects of two different pedagogical formats while keeping instructional content relatively constant.

Existing studies provide encouraging evidence for this approach but also underline the need for continued empirical

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testing. Gamification has demonstrated motivational promise in school and university physical education (Fernandez-Rio et al., 2020; Ferriz-Valero et al., 2020; Liu & Lipowski, 2021), has been associated with psychological need satisfaction and future physical activity intentions (Fernandez-Rio et al., 2022), and has shown beneficial effects in secondary school settings (Sotos-Martínez et al., 2024). At the same time, research on personalized physical education demonstrates that perceived competence is responsive to instructional context (Roure & Pasco, 2022), while broader studies of gamified physical activity suggest that motivational outcomes may depend on the specific way in which gamification is designed and experienced (Grech et al., 2024; Sotos-Martinez et al., 2024). Thus, rather than assuming that gamification is universally effective, controlled research is needed to determine which motivational indicators are most sensitive to the intervention and whether students' perceptions of competence improve relative to conventional instruction.

Given these theoretical considerations, prior empirical findings, and remaining gaps, the present study aimed to investigate the effect of gamification-based physical education on motivational indicators and perceived competence among seventh-grade female lower secondary school students.

2. Methods and Materials

2.1. Study Design and Participants

The present study was an applied, quasi-experimental investigation employing a pretest–posttest design with an experimental group and a control group. Data were collected through a field-based procedure. The statistical population consisted of seventh-grade female students enrolled in lower secondary schools in Tabriz, Iran. For sample selection, the researchers approached one lower secondary school in the city, from which two seventh-grade classes were selected through convenience sampling. The two intact classes were then randomly assigned to study conditions, with one class designated as the experimental group and the other as the control group. At the beginning of the study, the experimental group consisted of 34 students and the control group consisted of 29 students. All participants were 13 years old and met the eligibility requirements established for participation. The inclusion criteria were parental consent for participation, absence of cardiovascular or respiratory disorders that could interfere with participation in physical activity, absence of physical or motor impairments, and absence of reported disorders such as attention-deficit or hyperactivity-related problems. The exclusion criteria included absence from more than two instructional sessions and unwillingness of either the student or her parents to continue participation in the study. During the course of the intervention, one participant from the experimental group and two participants from the control group were excluded because they did not participate in the posttest assessment. In addition, the data of two participants from the experimental group and two from the control group were identified as outliers and were excluded from the final statistical analyses. Consequently, the final analytic sample consisted of 56 students, including 31 participants in the experimental group and 25 participants in the control group. Following the acquisition of the required permissions from the provincial Department of Education, one girls' lower secondary school in Tabriz was selected as the research setting. Two seventh-grade classes were subsequently selected, and one class was randomly allocated to the gamification condition and the other to the traditional instruction condition. Prior to implementation of the instructional programs, both groups completed the pretest measures. The experimental group then received basketball instruction through a gamification-based approach, whereas the control group was taught the same basketball content using a traditional skill-acquisition instructional model. In the traditional condition, consistent with the skill-based instructional approach described by Metzler (2017), the physical education teacher selected and introduced instructional tasks, determined the duration of instruction and practice, and directed the learning process, while students were expected to participate actively in the designated practice activities. To minimize possible instructional bias against the control condition, such as deliberately creating an unengaging or monotonous traditional class, the research team designed varied, structured, and high-quality instructional sessions for the control group while maintaining the defining characteristics of conventional teacher-directed physical education.

2.2. Measures

Students' motivational regulation in physical education was assessed using the 20-item Self-Regulation Questionnaire in Physical Education developed by Goudas et al. (1994). The instrument evaluates five dimensions of motivation, namely intrinsic motivation, identified regulation, introjected regulation, external regulation, and

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amotivation, with each dimension represented by four items. All items are introduced through the common stem, "I participate in physical education classes because...," and responses are recorded on a five-point Likert scale ranging from 1 (completely untrue) to 5 (completely true), with the midpoint of 3 indicating neither untrue nor true. The questionnaire is grounded in the continuum of self-determined motivation and enables the assessment of both relatively autonomous and relatively controlled forms of behavioral regulation in physical education settings. Evidence supporting the psychometric adequacy of the Persian version has previously been reported. In the study by Behzadnia et al. (2017), confirmatory factor analysis supported the proposed five-factor structure, and Cronbach's alpha coefficients greater than .75 were obtained for all dimensions, indicating satisfactory internal consistency. In the present study, Cronbach's alpha coefficients were .72 for intrinsic motivation, .71 for identified regulation, .71 for introjected regulation, .68 for external regulation, and .84 for amotivation. These coefficients indicated moderate to satisfactory internal consistency across the motivational dimensions and supported use of the instrument for evaluating changes in students' motivational regulation over the course of the intervention.

Perceived competence in basketball was assessed using an adapted three-item perceived competence scale previously employed in related studies (Marsh et al., 2006; Roure & Pasco, 2022). The scale was adapted specifically to evaluate students' subjective perceptions of their basketball ability within the physical education context. One representative item was, "Compared with my classmates, my level in basketball is...." Students responded to each item on a five-point Likert scale ranging from 1 (very poor) to 5 (very good), with a score of 3 representing neither poor nor good. Higher scores reflected stronger perceived competence in basketball. Previous research has provided evidence for the construct validity, predictive validity, and internal consistency of this type of perceived competence measure in educational and physical activity settings (Marsh et al., 2006; Sarrazin et al., 2002). In the present study, Cronbach's alpha for the three-item scale was .77, indicating satisfactory internal consistency and suggesting that the items coherently assessed the underlying construct of perceived basketball competence among the participating students.

2.3. Intervention

The gamification intervention was designed with reference to previous applications of gamification in physical education and sport instruction (Fernández-Río et al., 2020, 2022; Roure & Pasco, 2022) and was organized according to the framework proposed by Werbach and Hunter (2012), which conceptualizes gamification through three broad categories of dynamics, mechanics, and components. Basketball was selected as the instructional content because it formed part of the official physical education curriculum for seventh-grade students and represented a sport with which students were expected to become familiar during their physical education coursework. Both the experimental and control groups participated in eight instructional sessions delivered once per week, with each session lasting 90 minutes. Across the eight sessions, both groups practiced the same core basketball skills, including ball control, stationary dribbling, zigzag dribbling, obstacle dribbling, speed dribbling, dribbling under simulated defensive pressure, chest passing, overhead passing, bounce passing, passing in triangular formations, passing under simulated defensive pressure, and combinations of passing and dribbling. Each session included a warm-up phase consisting primarily of stretching and preparatory physical activities, a main instructional phase involving structured basketball skill-learning tasks, and a cool-down phase involving stretching and recovery activities. The fundamental distinction between the groups was therefore not the sport content or total instructional exposure but the pedagogical format through which the content was delivered. In the experimental condition, the instructional program was embedded within a fictional narrative centered on a land called "Basketland," inhabited by young heroes referred to as "Basket Players," who were required to cooperate to protect their land from hostile fictional creatures. The narrative provided continuity across sessions and created an overarching game-based context for the learning activities. At the beginning of the program, the teacher conducted several short basketball games to observe students' initial skill levels. These observations were subsequently used to construct relatively balanced teams of four to five students so that students with different levels of basketball proficiency were distributed fairly across teams. Each team selected a team name, logo, and avatar that represented the group throughout the narrative. Individual students also selected characters from a predefined list of fictional characters, each of which possessed a particular

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basketball-related "special power." Additional characters became available progressively as the narrative advanced and students reached higher levels. A structured point system was incorporated throughout the intervention. Students earned points for successfully learning new basketball skills, correctly performing instructional tasks, demonstrating effective individual and team performance, cooperating with teammates, and adhering to the rules of the activities. Accumulated points allowed teams to progress through levels and unlock new challenges and characters. The difficulty of instructional tasks increased progressively from simpler to more demanding activities so that students could experience attainable early successes before confronting more difficult basketball tasks. Based on accumulated team points, students could unlock Level 2 and Level 3, and at each new level they could select characters with stronger special abilities and greater point-earning potential. The predefined Level 1 list consisted of five characters, each associated with a specific skill-based capability; for example, one character could earn three team points by successfully completing controlled dribbling through a series of obstacles. The same principle was applied at Levels 2 and 3, where five additional predefined characters with progressively stronger abilities were made available. Importantly, students were given meaningful choice regarding which available character to select and which designated skill task to attempt, thereby increasing their active involvement in the learning process. A formal basketball challenge was also introduced every two sessions. These challenges targeted specific technical skills and required students to overcome increasingly demanding individual or team-based tasks, such as having all team members dribble through an obstacle course in less than one minute without making an error. Successful completion generated additional points and contributed to level progression. Cooperation was emphasized throughout the gamified program: students were encouraged to assist one another in successfully completing individual and team tasks, and the primary emphasis was placed on task completion, mutual support, collective point accumulation, and progression rather than outperforming other students. Immediate feedback constituted another central feature of the intervention. Students were informed in advance about the performance requirements for each task and the number of points available, and the teacher provided immediate feedback following exercises and challenges to help students identify strengths, correct errors, and improve subsequent performance. Instruction in both conditions was delivered by the same physical education teacher to control for teacher-related variability. The teacher was already experienced in conventional physical education instruction and, before commencement of the study, completed training under the supervision of a university specialist to become familiar with the principles and implementation procedures of gamification. A trained teaching assistant was additionally present during the experimental-group sessions and was responsible for recording points, assisting with the organization of gamified activities, and monitoring the implementation process. The use of the same teacher, identical basketball content, equal session duration, and comparable instructional quality across groups was intended to ensure that differences between the conditions could be attributed primarily to the gamification-based instructional structure rather than to differences in exposure, content, or teacher quality.

2.4. Data Analysis

Following completion of the pretest and posttest assessments, the collected data were coded and entered into IBM SPSS Statistics version 22 for statistical analysis. The analysis focused on determining whether changes in motivational regulation and perceived competence differed between students receiving gamification-based physical education and those receiving traditional instruction. Repeated-measures procedures were used to account for the within-participant effect of time and the between-participant effect of instructional group. Because the outcome variables included multiple dimensions of motivational regulation as well as perceived competence, both univariate and multivariate repeated-measures analyses of variance were employed as appropriate to examine changes from pretest to posttest and to determine whether these changes differed significantly between the experimental and control groups. Particular attention was given to the interaction between time and group, because a significant interaction would indicate that the pattern of change across the two measurement occasions differed according to instructional condition and could therefore be interpreted as evidence of an intervention effect. The statistical analyses were performed on the final sample of 56 participants after exclusion of participants who did not complete the posttest and observations identified as outliers.

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3. Findings and Results

The descriptive statistics for the pretest and posttest scores of the experimental and control groups across the study variables are presented in Table 1. These statistics include the means and standard deviations for the five motivational indicators—intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation—as well as perceived competence.

Table 1

Descriptive Statistics for the Dependent Variables by Group and Measurement Time

Dependent Variable	Component	Group	Pretest M (SD)	Posttest M (SD)
Motivational Indicators	Intrinsic Motivation	Experimental	18.32 (1.62)	18.58 (1.85)
		Control	18.44 (1.98)	17.88 (2.11)
	Identified Regulation	Experimental	17.42 (1.98)	18.10 (2.48)
		Control	17.52 (2.63)	17.32 (2.67)
	Introjected Regulation	Experimental	11.77 (3.75)	10.55 (4.23)
		Control	13.56 (4.66)	11.96 (3.94)
	External Regulation	Experimental	9.68 (3.12)	8.71 (3.04)
		Control	10.88 (2.60)	11.24 (2.37)
	Amotivation	Experimental	6.32 (2.45)	5.68 (2.39)
		Control	5.60 (1.94)	5.92 (2.47)
Perceived Competence	—	Experimental	11.58 (2.50)	12.48 (1.79)
		Control	12.08 (2.10)	11.80 (2.22)

As shown in Table 1, the pattern of descriptive changes differed across the two groups. Intrinsic motivation in the experimental group increased slightly from 18.32 at pretest to 18.58 at posttest, whereas it declined from 18.44 to 17.88 in the control group. Identified regulation similarly increased in the experimental group from 17.42 to 18.10 but showed a slight decrease in the control group from 17.52 to 17.32. Introjected regulation decreased in both groups, from 11.77 to 10.55 in the experimental group and from 13.56 to 11.96 in the control group. A more distinct between-group pattern was observed for external regulation: the experimental group showed a decrease from 9.68 to 8.71, whereas the control group showed a slight increase from 10.88 to 11.24. Amotivation decreased from 6.32 to 5.68 in the experimental group but increased slightly from 5.60 to 5.92 in the control group. Perceived competence also demonstrated a differential pattern, increasing from 11.58 to 12.48 in the experimental group while decreasing from 12.08 to 11.80 in the control group. These descriptive trends suggested potentially different effects of the two instructional approaches, which were subsequently examined using inferential analyses.

Prior to conducting the inferential analyses, the assumptions required for repeated-measures analysis of variance were examined. Normality of the distributions was assessed using skewness and kurtosis indices. For all study variables, both indices fell within the acceptable range of −2 to +2, supporting the assumption of approximate normality. Homogeneity of variances across the experimental and control groups at each measurement occasion was assessed using Levene's test, and the results were nonsignificant for all variables ($p > .05$), indicating that the homogeneity-of-variance assumption was satisfied. In addition, independent-samples t tests were conducted to examine whether the two groups differed significantly at pretest. No statistically significant pretest differences were found between the experimental and control groups for any of the dependent variables ($p > .05$), indicating baseline comparability. Given that the study included two measurement occasions and two groups, the data were subsequently analyzed using a 2 (Time: pretest vs. posttest) × 2 (Group: experimental vs. control) repeated-measures analysis of variance. For the multidimensional motivational indicators, multivariate repeated-measures analysis was first conducted, followed by univariate analyses, whereas perceived competence was examined using univariate repeated-measures analysis.

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Table 2

Results of Repeated-Measures Analysis of Variance for Motivational Indicators and Perceived Competence

Outcome / Effect	Test	df	F	p	Partial η^2
Motivational Indicators – Time	Wilks' Lambda = .845	5, 50	1.837	.123	.155
Motivational Indicators – Time × Group	Wilks' Lambda = .879	5, 50	1.375	.250	.121
Motivational Indicators – Group	Wilks' Lambda = .772	5, 50	2.955	.021	.228
Intrinsic Motivation – Group	Univariate ANOVA	1, 54	0.487	.488	.009
Identified Regulation – Group	Univariate ANOVA	1, 54	0.332	.567	.006
Introjected Regulation – Group	Univariate ANOVA	1, 54	2.915	.094	.051
External Regulation – Group	Univariate ANOVA	1, 54	9.087	.004	.144
Amotivation – Group	Univariate ANOVA	1, 54	0.235	.630	.004
Perceived Competence – Time	Univariate ANOVA	1, 54	1.201	.278	.022
Perceived Competence – Group	Univariate ANOVA	1, 54	0.033	.857	.001
Perceived Competence – Time × Group	Univariate ANOVA	1, 54	4.328	.042	.074

The multivariate repeated-measures analysis for motivational indicators showed that the main effect of time was not statistically significant, Wilks' $\Lambda = .845$, $F(5, 50) = 1.837$, $p = .123$, partial $\eta^2 = .155$, indicating that, when all motivational dimensions were considered simultaneously, there was no overall change from pretest to posttest irrespective of group membership. The Time × Group interaction was also nonsignificant, Wilks' $\Lambda = .879$, $F(5, 50) = 1.375$, $p = .250$, partial $\eta^2 = .121$, suggesting that the combined pattern of change across the motivational indicators did not differ significantly between the two instructional conditions. In contrast, the multivariate main effect of group was statistically significant, Wilks' $\Lambda = .772$, $F(5, 50) = 2.955$, $p = .021$, partial $\eta^2 = .228$, demonstrating an overall difference between the gamification and traditional instruction groups across the set of motivational indicators. Follow-up univariate analyses showed no significant group effect for intrinsic motivation, $F(1, 54) = 0.487$, $p = .488$, partial $\eta^2 = .009$; identified regulation, $F(1, 54) = 0.332$, $p = .567$, partial $\eta^2 = .006$; introjected regulation, $F(1, 54) = 2.915$, $p = .094$, partial $\eta^2 = .051$; or amotivation, $F(1, 54) = 0.235$, $p = .630$, partial $\eta^2 = .004$. However, a statistically significant group difference was found for external regulation, $F(1, 54) = 9.087$, $p = .004$, partial $\eta^2 = .144$. Inspection of the descriptive statistics indicated that external regulation decreased in the gamification group while increasing slightly in the traditional instruction group, suggesting that exposure to gamified physical education was associated with lower externally regulated motivation. For perceived competence, neither the main effect of time, $F(1, 54) = 1.201$, $p = .278$, partial $\eta^2 = .022$, nor the main effect of group, $F(1, 54) = 0.033$, $p = .857$, partial $\eta^2 = .001$, was statistically significant. Nevertheless, the Time × Group interaction was significant, $F(1, 54) = 4.328$, $p = .042$, partial $\eta^2 = .074$, demonstrating that the pattern of change in perceived competence from pretest to posttest differed significantly between the two groups. Consequently, Bonferroni-adjusted within-group comparisons were conducted to determine the source of this interaction.

Table 3

Bonferroni Post-Hoc Comparisons for Perceived Competence

Dependent Variable	Group	Mean Difference (Pretest − Posttest)	Standard Error	p
Perceived Competence	Experimental	−0.903	0.380	.021
Perceived Competence	Control	0.280	0.423	.511

As presented in Table 3, the Bonferroni-adjusted pairwise comparisons indicated a statistically significant improvement in perceived competence among students in the gamification group. The pretest-to-posttest mean difference was −0.903, SE = 0.380, $p = .021$, reflecting an increase in perceived competence from the pretest to the posttest assessment. In contrast, the traditional instruction group showed no statistically significant within-group change in perceived competence, with a mean difference of 0.280, SE = 0.423, $p = .511$. Thus, although overall perceived competence did not differ significantly when only the main effects of time or group were considered, the significant Time × Group interaction and subsequent Bonferroni comparisons demonstrated that students

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receiving gamification-based physical education experienced a significant increase in perceived basketball competence, whereas students receiving conventional instruction did not show a meaningful change over the same period.

4. Discussion

The present study investigated the effect of gamification-based physical education on motivational indicators and perceived competence among seventh-grade female lower secondary school students. The findings showed that the gamification intervention produced a significant reduction in external regulation compared with traditional physical education instruction, whereas no statistically significant between-group differences were observed for intrinsic motivation, identified regulation, introjected regulation, or amotivation. In addition, perceived competence demonstrated a significant Time × Group interaction, and subsequent Bonferroni comparisons revealed that perceived competence increased significantly from pretest to posttest in the gamification group, while no significant change occurred in the traditional instruction group. Taken together, these findings indicate that gamification did not influence all dimensions of motivational regulation equally, but it appeared to reduce reliance on externally controlled motives and enhance students' perceptions of competence in basketball. This pattern is consistent with the theoretical proposition that the effectiveness of gamification depends not merely on the presence of game elements but on how these elements restructure students' experiences of choice, challenge, feedback, mastery, and social interaction.

The significant reduction in external regulation is one of the most important findings of the present study. External regulation represents one of the most controlled forms of motivation and refers to participation driven primarily by external demands, rewards, punishments, approval, or other contingencies outside the individual (Ryan & Deci, 2020). From the perspective of self-determination theory, a reduction in external regulation may be interpreted as movement away from a highly controlled motivational orientation, even when this movement does not immediately translate into statistically significant increases in intrinsic motivation or identified regulation. This interpretation is compatible with evidence showing that motivational quality in physical education is highly sensitive to the extent to which the instructional environment supports autonomy, competence, and relatedness (Vasconcellos et al., 2020). In the present study, the gamification program included meaningful choice of characters and tasks, progressive challenges, immediate feedback, team collaboration, and opportunities to earn points through both individual and collective success. Such features may have made participation feel less imposed by the teacher and more connected to students' own decisions and involvement, thereby decreasing the extent to which they perceived participation as externally controlled.

This finding is also in line with previous studies showing that gamification can support more adaptive motivational experiences in physical education. Fernandez-Rio et al. reported that gamified physical education environments are feasible and can positively influence students' engagement and perceptions of the learning process (Fernandez-Rio et al., 2020). Similarly, gamified interventions have been associated with improvements in basic psychological need satisfaction, motivation, and intentions to remain physically active (Fernandez-Rio et al., 2022). In secondary school students specifically, gamification has been shown to affect motivation and psychological need satisfaction, suggesting that the adolescent educational context may be particularly responsive to carefully structured game-based pedagogies (Sotos-Martínez et al., 2024). The current finding further complements research indicating that gamification can positively influence learning motivation in physical education and sport-related educational contexts (Ferriz-Valero et al., 2020; Liu & Lipowski, 2021). However, unlike studies that have reported broad improvements in overall motivation, the present results suggest a more selective effect concentrated on the controlled end of the motivational continuum. This distinction may reflect differences in participant age, intervention duration, cultural context, measurement tools, or the specific configuration of gamification elements.

The reduction in external regulation may also be explained by the structure of the intervention itself. Although points and rewards are often assumed to function as external motivators, their psychological meaning depends on how they are embedded within the learning environment. When points operate solely as incentives or instruments of comparison, they may reinforce external control. In contrast, when they provide information about progress, acknowledge mastery, and allow access to progressively challenging tasks, they may function as competence-related feedback rather than controlling rewards. The intervention in the present study emphasized task completion, cooperation, advancement, and skill acquisition rather than competition

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for superior rank. Students could choose characters, engage in different skill challenges, and contribute to team progress, which may have weakened perceptions of coercion. This interpretation accords with self-determination theory, which emphasizes that identical external events can have different motivational consequences depending on whether they are experienced as controlling or informational (Ryan & Deci, 2020). It also aligns with findings that need-supportive physical education environments foster more adaptive motivational processes than controlling teaching environments (Behzadnia et al., 2022).

The absence of statistically significant effects on intrinsic motivation, identified regulation, introjected regulation, and amotivation also deserves careful consideration. Although the experimental group showed favorable descriptive trends in several motivational dimensions, these changes did not reach statistical significance. One explanation may be that eight weekly sessions were sufficient to reduce externally controlled participation but not long enough to produce deeper internalization of motivation. Intrinsic motivation develops when students experience activities as inherently enjoyable and satisfying, while identified regulation requires students to internalize the personal value and importance of participation (Ryan & Deci, 2020). Such motivational transformations may require sustained exposure to supportive instructional climates across a longer period. Longitudinal research in physical education has indicated that motivational processes and psychological need satisfaction develop dynamically across time rather than changing immediately in response to a short-term intervention (Behzadnia, Fazeli, et al., 2024). Therefore, the nonsignificant changes in intrinsic and identified motivation should not necessarily be interpreted as evidence that gamification is ineffective; rather, the intervention may have initiated a motivational shift that was not sufficiently developed to produce statistically detectable changes in these more autonomous forms of regulation.

Another possible explanation concerns the novelty effect of gamification. At the beginning of a gamified intervention, students may respond strongly to stories, avatars, points, challenges, and new classroom structures because they differ markedly from their usual educational experiences. However, novelty does not automatically become intrinsic interest. Students may initially become more attentive and behaviorally engaged without substantially changing the reasons underlying their participation. Findings from gamified physical activity studies suggest that motivational responses depend on intervention characteristics and may not be uniform across outcomes (Grech et al., 2024). Likewise, research with university students indicates that gamification can enhance motivation, although different components of motivation may respond differently depending on how the gamified activities are structured (Sotos-Martinez et al., 2024). The absence of significant change in intrinsic motivation in the present study may therefore indicate that students found the gamified environment engaging but had not yet internalized basketball participation as inherently satisfying to a degree sufficient to distinguish them statistically from students receiving traditional instruction.

The lack of significant change in introjected regulation is also understandable in light of the nature of this motivational dimension. Introjected regulation is characterized by partially internalized pressure, such as participation to avoid guilt, preserve self-worth, or demonstrate adequacy. Gamification does not necessarily eliminate these internal pressures, especially in adolescence, when peer evaluation, social comparison, and self-consciousness may remain influential. Even in a cooperative learning environment, students may continue to evaluate their performance relative to classmates or feel pressure to contribute successfully to their team. As a result, the intervention may have reduced direct external pressure without substantially altering internalized forms of pressure. The absence of a significant change in amotivation may similarly reflect relatively low initial amotivation scores, leaving limited room for further reduction. More generally, evidence indicates that motivational regulations are multidimensional and should not be expected to respond uniformly to a single instructional intervention (Behzadnia et al., 2018). The current findings therefore reinforce the value of assessing separate motivational dimensions rather than relying on a global motivation score.

The significant improvement in perceived competence among students in the gamification group represents the second major finding of the study. Perceived competence is central to students' engagement in physical education because it reflects their belief that they can successfully perform required motor tasks and improve through practice. The intervention was deliberately structured around progressive levels, achievable challenges, immediate feedback, repeated opportunities for success, and visible indicators of advancement. These features likely helped students recognize their own progress and interpret improvement as evidence of growing ability. The importance of perceived competence in physical education

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has been demonstrated in previous work showing that instructional context can shape students' evaluations of their capabilities (Roure & Pasco, 2022). Research on perceived motor competence also emphasizes that subjective competence is a meaningful psychological construct associated with participation and motor development (Ramezanzadeh et al., 2021). Thus, the significant increase observed in the experimental group suggests that gamification created a learning environment in which skill development became more visible and psychologically salient to students.

The finding concerning perceived competence is consistent with previous gamification studies reporting positive psychological and motor outcomes. Wibowo found that gamification in elementary physical education enhanced self-esteem, satisfaction, and motor skills, suggesting that game-based learning structures can strengthen positive self-evaluations in physical activity contexts (Wibowo, 2024). Davies et al. similarly showed that gamified physical activity interventions may influence both physical and cognitive outcomes in younger learners (Davies et al., 2024). Although these studies involved different age groups, they support the proposition that gamification can facilitate mastery experiences and positive competence perceptions. Research on context personalization in physical education has also demonstrated that adapting instructional experiences to students' interests can improve perceived competence (Roure & Pasco, 2022). In the present intervention, the use of avatars, choice, progressive unlocking of characters, increasingly demanding basketball challenges, and team-based missions may have provided a comparable form of contextual personalization and active involvement.

Immediate feedback may have been particularly important in explaining the improvement in perceived competence. Students were informed of the criteria for successful performance and received feedback immediately after drills and challenges. This provided clear information about what they had done correctly and how they could improve. In traditional instruction, feedback may also be present, but gamification makes progress more explicit by linking performance to points, levels, unlocked content, and narrative advancement. Consequently, students may become more aware of their incremental improvement. This mechanism is consistent with need-supportive teaching principles, in which informational feedback and appropriately structured challenges are used to strengthen perceptions of effectiveness (Behzadnia et al., 2022). It is also compatible with findings that basic psychological need satisfaction, particularly competence satisfaction, contributes to more positive motivation and well-being in physical education (Behzadnia, Fazeli, et al., 2024; Vasconcellos et al., 2020).

The cooperative structure of the gamified intervention may also have supported perceived competence. Students were organized into relatively balanced teams and encouraged to help one another complete tasks and obtain collective points. This approach shifted the emphasis from outperforming classmates toward successfully completing challenges and contributing to team progress. Such a structure can create opportunities for peer support, observational learning, encouragement, and shared success, all of which may reduce fear of failure and strengthen perceptions of capability. Previous research has shown that gamification can positively influence classroom climate and interpersonal relationships when physical activity is embedded within cooperative and responsibility-oriented structures (Dólera-Montoya et al., 2021; Melero-Canas et al., 2021). Gamified exergame-based physical education has similarly been associated with positive psychological experiences and favorable perceptions of the instructional process (Quintas-Hijós et al., 2020; Quintas et al., 2020). These studies support the interpretation that the social architecture of gamification may be as important as its game mechanics.

The combination of reduced external regulation and increased perceived competence is theoretically meaningful. Students in the gamification condition appeared to become less dependent on external reasons for participation while simultaneously developing stronger perceptions of their own basketball ability. From a self-determination perspective, competence satisfaction can facilitate internalization when it occurs alongside autonomy and relatedness support (Ryan & Deci, 2020). Although the present intervention did not produce significant increases in intrinsic or identified motivation within the eight-session period, improved competence may represent an important preliminary condition for subsequent motivational development. Students who increasingly believe that they are capable of succeeding may become more willing to engage voluntarily, experiment with difficult tasks, and derive satisfaction from skill improvement over time. This possibility is consistent with evidence showing that motivation and competence-related experiences in physical education are associated with longer-term participation intentions (Behzadnia, Mollaei Zangi, et al., 2024; Fernandez-Rio et al., 2022).

The findings also have implications for understanding gamification as a pedagogical strategy rather than a simple collection of entertaining features. Gamification may be most effective when its components are integrated with established motivational principles. Storytelling, avatars, levels, challenges, points, cooperation, and feedback can become educationally meaningful when they are used to support mastery, agency, and social connection. This distinction may help explain why gamification studies sometimes report mixed findings. Interventions that emphasize rankings, rewards, and competition may produce different motivational outcomes from interventions that prioritize personalized challenge, cooperation, and informational feedback. Studies in different educational contexts have shown that gamification can increase engagement and motivation, including in language education, virtual learning, and interactive technology-based instruction (Banik & Gullapelly, 2025; Diana et al., 2025; Shafiei Sarvestani et al., 2025). However, the present study suggests that in school physical education, the most immediate psychological benefits may emerge in the form of reduced controlled motivation and enhanced perceived competence rather than broad improvements across every motivational dimension.

5. Conclusion

Overall, the findings support the use of carefully designed gamification as a potentially valuable approach in lower secondary physical education. The intervention did not produce universal motivational benefits, and therefore the results should not be interpreted as indicating that gamification automatically improves all aspects of motivation. Instead, its effects appeared selective and theoretically coherent. The significant reduction in external regulation indicates that students may have experienced participation as less externally controlled, while the increase in perceived competence suggests that the gamified environment strengthened students' confidence in their basketball capabilities. Given the central role of competence and motivational quality in sustained physical activity engagement, these outcomes are educationally relevant and provide additional support for the integration of need-supportive gamification principles into school physical education.

6. Limitations & Suggestions

Several limitations should be considered when interpreting the findings. First, the study was conducted with seventh-grade female students from a single lower secondary school in Tabriz, which limits the generalizability of the results to boys, students of other age groups, schools with different socioeconomic or educational characteristics, and other geographical regions. Second, the sample size was relatively modest and consisted of intact classes selected through convenience sampling, which may have reduced statistical power and limited the ability to detect smaller intervention effects. Third, the intervention lasted only eight weeks, and only pretest and posttest measurements were obtained; therefore, it was not possible to determine whether the observed improvement in perceived competence and reduction in external regulation were maintained over time. Fourth, motivational indicators and perceived competence were measured using self-report instruments, which are potentially affected by social desirability, response tendencies, and students' subjective interpretations of questionnaire items. Fifth, because the gamification program simultaneously incorporated several components, including narrative, points, levels, avatars, challenges, cooperation, choice, and immediate feedback, it was not possible to determine which specific element or combination of elements produced the observed effects. Finally, although the same teacher taught both groups and efforts were made to provide high-quality instruction in the traditional condition, complete elimination of teacher expectancy and implementation effects cannot be guaranteed.

Future studies should replicate the present research using larger and more diverse samples drawn from multiple schools, geographical regions, educational levels, and both genders to increase external validity. Longer interventions with follow-up assessments are recommended to determine whether changes in motivational regulation and perceived competence persist after the novelty of gamification diminishes. Future research could also employ randomized controlled designs at the class or school level and include objective measures of physical activity, motor performance, participation, attendance, and skill acquisition alongside psychological outcomes. Researchers are encouraged to examine the individual effects of different gamification components by comparing, for example, cooperative versus competitive structures, reward-oriented versus mastery-oriented systems, narrative versus non-narrative designs, and interventions with or without student choice. Qualitative

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interviews, focus groups, and classroom observations could further clarify how students experience gamified physical education and why certain students benefit more than others. Future studies should also examine potential mediating mechanisms such as autonomy, competence, relatedness, enjoyment, situational interest, and perceived teacher support, as well as moderators such as initial skill level, prior sport experience, baseline motivation, personality, and preference for competitive or cooperative learning environments.

From a practical perspective, physical education teachers may consider incorporating gamification into skill instruction when the aim is to create a more engaging, competence-supportive, and less controlling learning environment. Gamification should not be limited to giving students points or rewards; rather, teachers should design progressive challenges, provide frequent informational feedback, allow meaningful choices, create opportunities for cooperative success, and ensure that tasks remain achievable while becoming gradually more demanding. Team structures should emphasize mutual assistance and collective learning rather than excessive social comparison. Teachers can also use narratives, avatars, levels, and skill missions to make routine practice more meaningful without changing curricular learning objectives. In basketball and similar sports, technical skills can be organized into progressive challenges that allow students to observe their own development and experience repeated mastery. Schools should provide teachers with training in motivationally supportive gamification design so that game elements are used to strengthen learning rather than distract from instructional goals. Particular attention should be paid to students with lower confidence or weaker motor skills, because gamified progression and individualized success criteria may help these students experience competence and remain actively involved in physical education.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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All authors equally contributed to this article.

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