

Effects of using positive and corrective feedback on students' performance in physical education classes

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Abstract:

Problem Statement: Feedback is a fundamental instructional tool in Physical Education, yet evidence remains limited on how different feedback conditions affect students' technical-tactical outcomes in authentic school sport settings. **Approach:** A pre-post intervention was performed within a 10th-grade basketball instructional unit in a Portuguese secondary school. Thirteen students (n = 13) with no competitive basketball experience were randomly assigned to one of two conditions across 12 lessons: (1) corrective feedback only, provided in response to errors aligned with task objectives; or (2) a combined condition integrating positive reinforcement with corrective feedback and guided reflection on progress. Students were assessed in representative small-sided game situations using video-recorded play and observational scoring with a validated game performance assessment framework focused on decision making, technical execution, support actions, guarding behaviors, game involvement, and overall game performance. Data were analyzed using within-group and between-group comparisons, complemented by effect size estimation. **Purpose:** This study examined whether combining positive and corrective feedback would lead to greater improvements in technical-tactical performance than using corrective feedback alone. **Results:** Groups showed comparable baseline performance. Both conditions demonstrated meaningful improvements from the initial to the final assessment. The corrective-feedback condition improved decision making, support actions, game involvement, and overall game performance. The combined condition improved skill execution, support actions, and overall game performance, with a positive trend in decision making. In the final between-group comparison, a statistically significant difference emerged only for game involvement, favoring the corrective-feedback condition, while all other indicators showed no statistically significant differences. **Conclusions:** In this short, authentic instructional unit, adding positive reinforcement to corrective feedback did not produce consistent advantages over corrective feedback alone across technical-tactical indicators. Both approaches were associated with improvements, with the combined condition showing more consistent gains in technical execution and support actions. Findings are preliminary due to the small sample and limited duration, and future studies should use larger samples, longer interventions, and systematic recording of feedback delivery characteristics.

Key Words: Basketball; Instructional intervention; Feedback; Small-sided games; Tactical decision making

Introduction

Physical Education (PE) plays a fundamental role in school curricula worldwide, contributing to students' motor, cognitive, emotional, and social development (Borghouts, Slingerland, & Haerens, 2017). Regular engagement in physical activity within the school context promotes health, physical fitness, and the development of social and personal skills (Garcia, 2016; Ruedl et al., 2021). Beyond encouraging sport participation and teamwork, PE contributes to socialization and the internalization of values such as respect, resilience, and discipline (Ferraz et al., 2020). Moreover, PE may play a role in supporting mental health and emotional well-being, while providing opportunities for the development of interpersonal relationships (Biddle & Asare, 2011).

At the secondary-school level, PE becomes particularly relevant because, between the ages of 14 and 18, adolescents consolidate their identity and establish habits that shape adult life (Haerens et al., 2010; Trudeau & Shephard, 2008). PE classes often represent students' only opportunity to engage in physical activity, explore sport modalities, and develop motor and social skills (McKenzie, 2007). In addition, evidence suggests that regular participation in PE programs is associated with improvements in academic performance, attention, and social skills (Trudeau & Shephard, 2008). However, these potential benefits depend on the quality of the pedagogical process, since curriculum, pedagogy, and assessment have been described as interrelated dimensions of quality PE (Borghouts et al., 2017). Therefore, students' learning in PE is strongly influenced by how teachers

plan learning tasks, clarify goals, monitor performance, and provide information that supports progression (Borghouts et al., 2017; Ní Chróinín et al., 2018).

Within this context, the PE teacher plays a crucial pedagogical role and should act as an active mediator by creating meaningful learning experiences that promote active and healthy lifestyles. To achieve this, it is essential for teachers to establish a safe, inclusive, and motivating environment, adapting strategies to students' needs, interests, and capabilities, and implementing appropriate pedagogical planning, class management, and instructional methods (Haerens et al., 2010). Aligning teaching practices with guiding documents, such as the National Physical Education Program and the Essential Learnings, is fundamental to ensuring instructional effectiveness (Ní Chróinín, Fletcher, & O'Sullivan, 2018).

Munna and Kalam (2021) also argue that the teaching-learning process in PE should be intentional and structured, aiming to develop competencies through careful selection of content, pedagogical strategies, and assessment methods. Teaching quality depends strongly on teachers' preparation and their ability to adapt to classroom diversity using well-defined instructional models that guide all phases of pedagogical practice (Metzler, 2011). Thus, effective teaching in PE should provide students with clear task goals, appropriate opportunities for practice, and feedback that helps them understand how to improve their performance (Hattie & Timperley, 2007; Treschman, Stylianou, & Brooks, 2024).

Instruction is one of the pillars of the educational process in PE; it is through instruction that learning is organized, guided, and assessed, fostering students' technical, tactical, physical, and psychological development (Colquitt et al., 2017; Metzler & Colquitt, 2021; Wen & Cai, 2024). Because students differ in skill level, understanding, and learning pace, instruction should be flexible, adaptive, and responsive to individual and group needs (Santos et al., 2021). In game-based contexts, such as basketball, instruction should support students in interpreting game situations, selecting appropriate responses, and applying technical skills according to tactical problems (Breed, Lindsay, Kittel, & Spittle, 2025; Renshaw et al., 2016). This is important because game performance depends not only on the execution of isolated technical actions, but also on knowing when, where, and why to use those actions under changing conditions (Breed et al., 2025).

Beyond motor development, instruction should also stimulate decision-making and problem-solving, fostering autonomy and critical thinking. Students are encouraged to reflect on their performance, develop strategies to overcome challenges, and participate actively in knowledge construction (Santos et al., 2021). A welcoming and stimulating learning environment is therefore essential for students to feel motivated and valued (Colquitt et al., 2017).

In this context, feedback plays a central role in the educational process, as it enables teachers to provide relevant information about students' performance, helping them recognize progress and identify areas requiring improvement. Feedback may serve a motivational function by reinforcing effort and self-confidence, or a corrective function by guiding students to overcome difficulties and refine skills (Hattie & Timperley, 2007; Santos et al., 2021). According to Hattie and Timperley (2007), feedback is most useful when it helps learners understand the learning goal, their current level of performance, and the next steps required to reduce the gap between current and desired performance. Recent PE-specific literature reinforces this perspective by arguing that feedback should not be reduced to teacher comments but should be understood as a process that supports students in interpreting and using information to advance learning (Treschman et al., 2024).

Literature distinguishes several types of feedback: global, group-based, or individualized; affirmative, corrective, or adverse; and general or specific (Shima & Suzuki, 2024). Among these forms, positive and corrective feedback are particularly relevant in PE because they may influence both students' motivation and their technical-tactical learning. Positive feedback may support perceived competence, vitality, and engagement during physical tasks, particularly when it is informative and oriented toward effort, strategies, improvement, or specific motor and tactical behaviors (García et al., 2019; Mouratidis et al., 2008). However, its effectiveness depends on its content and pedagogical function. Generic praise may contribute to a positive motivational climate, but it has limited instructional value when it does not clarify what students did well or what should be maintained in future practice situations (Hattie & Timperley, 2007; Henderlong & Lepper, 2002). In this regard, process-oriented feedback appears more useful than person-focused praise because it emphasizes controllable aspects of learning, such as effort, strategy use, and task-specific improvement (De Meester et al., 2024).

In turn, corrective feedback is pedagogically relevant because it provides information about the discrepancy between the performed action and the task goal, helping students identify errors, adjust decisions, and improve the quality of motor execution. In PE, evidence indicates that feedback can enhance motor skill learning, although its effects depend on the type of information provided, its specificity, timing, frequency, mode of delivery, task complexity, and students' initial skill level (Han et al., 2022; Petancevski et al., 2022; Zhou et al., 2021).

Therefore, corrective feedback is likely to be more effective when it is linked to clear learning goals and success criteria, allowing students to understand not only what was incorrect, but also how to improve (Brookhart, 2013; Wiggins, 2012).

Despite the recognized relevance of feedback in PE, there remains limited experimental evidence comparing how different feedback conditions affect students' technical-tactical performance in authentic school sport units (De Meester et al., 2024; Han et al., 2022; Shima & Suzuki, 2024; Treschman et al., 2024). This

represents an important scientific and pedagogical gap, as PE teachers frequently use feedback during lessons but still require evidence-informed guidance on how to combine corrective information with positive reinforcement to support students' performance, engagement, and understanding of game play. Thus, examining feedback in real school contexts may contribute both to instructional theory and to practical pedagogical decision-making in PE.

Therefore, the present study addresses a relevant scientific and pedagogical problem: feedback is frequently used by PE teachers, but there is still limited evidence on how different feedback conditions affect students' technical-tactical performance in real school sport units (Han et al., 2022; Treschman et al., 2024). This issue has practical relevance because teachers need evidence-informed guidance on how to use feedback deliberately, not only to correct errors but also to reinforce progress, sustain engagement, and support students' understanding of game performance (De Meester et al., 2024; Hattie & Timperley, 2007; Petancevski et al., 2022).

To address this gap, a pre-post intervention was conducted during a 10th-grade basketball instructional unit, comparing two feedback conditions across authentic PE lessons: corrective feedback alone and a combined condition integrating positive reinforcement, corrective feedback, and guided reflection. The primary aim of this study was to analyze the impact of positive and corrective feedback on students' technical-tactical performance in PE classes. Specifically, the study examined how corrective feedback alone, compared with the combined feedback condition, influenced game performance indicators. It was hypothesized that the structured combination of positive and corrective feedback would produce greater improvements in students' technical-tactical performance than the use of corrective feedback alone.

Material & methods

Participants

The present study used a convenience sample comprising 13 secondary school students (10th grade) from a Portuguese school. Although small, this sample size is consistent with exploratory intervention studies conducted in authentic PE settings using the GPAI (cf. Memmert & Harvey, 2008). Participants were aged 15 to 18 years, with a mean age of 15.77 ± 0.72 years. None of the participants had federated/competitive experience in basketball, having only been exposed to the sport within the context of Physical Education classes. Parents or legal guardians provided written informed consent for participation. Inclusion criteria were: (1) absence of health problems, (2) absence of injuries, and (3) regular attendance in Physical Education classes. Accordingly, any participant who failed to meet one of these requirements was excluded from the study. The study was approved by the institutional authorities of the participating school and conducted in accordance with the Declaration of Helsinki for research involving human subjects.

Table 1. Demographic data on age for the GCF and GPCF groups.

Descriptive analysis	Groups		Total sample
	GCF	GPCF	
N	7	6	13
M	15.86	15.67	15.77
DP	0.90	0.52	0.73

N = number of participants; M = mean; SD = standard deviation; GCF = Corrective Feedback Group; GPCF = Positive + Corrective Feedback Group.

Procedures

The pedagogical intervention was implemented within the Basketball Instructional Unit during the Physical Education teaching practicum. It took place during the second academic term and comprised 24 class periods (12 lessons). Its primary aim was to examine the impact of different feedback conditions on students' technical-tactical skill development in game contexts, through the establishment of two distinct intervention groups: the Corrective Feedback Group (GCF) and the Positive + Corrective Feedback Group (GPCF). Prior to the start of the study, informed consent was obtained from students and their parents/guardians, ensuring compliance with ethical principles and safeguarding participants' well-being. Students were randomly assigned to groups to promote baseline comparability and minimize potential bias in the analysis of intervention effects (GCF: 2 boys and 5 girls; GPCF: 2 boys and 4 girls).

A baseline assessment (pretest) was conducted to establish a starting point for analyzing participants' progress across the unit. Subsequently, a final assessment (posttest) was administered to measure and compare changes in technical-tactical performance as a function of the feedback conditions implemented. All assessments were conducted using small-sided game situations (3 vs. 3), as these were considered authentic contexts that closely reflect the game logic of basketball. At each assessment point, participants were video recorded for 15 minutes. Throughout the Basketball Instructional Unit, lessons were planned to use a game-centered approach, aiming to ensure that tasks were representative of and functional for the sport's internal logic. To this end, small-sided games, problem-solving situations, and conditioned games were used systematically to emphasize specific

technical–tactical behaviors and to create frequent opportunities for feedback delivery. In the GCF, the intervention relied exclusively on corrective feedback aligned with each task’s specific objectives, without explicit reference to overall performance or progress over time. In contrast, the GPCF intervention combined positive and corrective feedback, included individualized guidance, and incorporated regular moments of reflection on performance and achieved progress; instructional objectives and intervention focus were adjusted to students’ demonstrated needs. Thus, although both groups practiced in game-representative contexts, the strategies differed in the type and intentionality of the feedback provided: whereas the GCF followed a model of task-centered, point-of-need correction, the GPCF emphasized more continuous and formative support, integrating positive reinforcement, technical correction, and guided reflection aimed at improving performance.

Instrument and Definition of Study Variables

The Game Performance Assessment Instrument (GPAI) was used. GPAI is an assessment tool developed and validated by Oslin et al. (1998) that allows the evaluation of tactical performance through observation of seven game components related to the resolution of tactical problems. In this study, six indicators were derived from the GPAI framework, as described in Table 2: Decision Making, Skill Execution, Support Actions, Guarding/Marking, Game Involvement, and Game Performance.

Table 2. Description of the indicators assessed with the GPAI.

Game Component	Description
Decision Making	- Upon receiving the ball, turns to face the basket in an offensive stance. - Shoots if the basket is within range and the defender is not applying pressure. - Passes if a teammate is unmarked and in a more advanced offensive position. - Creates separation from the defender using the dribble when none of the above options are available.
Technical Skill Execution	- Shooting: Extension of the shooting arm; wrist flexion. - Passing: Directed to the teammate; the ball arrives in good condition. - Dribbling: Does not look at the ball; does not “carry” the ball.
Support Actions	- Seeks to create passing lanes by moving into open space. - Does not move within 3 m of the ball carrier.
Guarding/Marking	- Adopts a defensive stance, tracking the direct opponent. - Positions between the opponent and the basket, disrupting their actions.

Assessments were conducted through the observation of a 15-minute video in two situations: Pre (IA) and Post (FA). Students’ actions were classified as appropriate or inappropriate, always taking the observed context into account. All GPAI assessments were coded by an external university researcher with expertise in research, teaching, and performance analysis in invasion games. The evaluator did not participate in the intervention and was blinded to students’ group allocation and the study hypotheses; to ensure this, all video files were anonymized and coded using neutral identifiers. Although a classical double-blind design is not feasible in school-based educational research, this single-blind coding procedure was implemented to minimize potential evaluator bias. To determine the indices, a table was developed based on the model proposed by Memmert and Harvey (2008).

Table 3: Calculation of GPAI indices—adapted from Memmert and Harvey (2008).

Index	Formula Calculation
Decision Making Index (DMI)	No. of appropriate actions / (No. of appropriate actions + No. of inappropriate actions)
Skill Execution Index (SEI)	No. of appropriate actions / (No. of appropriate actions + No. of inappropriate actions)
Support Actions Index (SAI)	No. of appropriate actions / (No. of appropriate actions + No. of inappropriate actions)
Guarding/Marking Index (GMI)	No. of appropriate actions / (No. of appropriate actions + No. of inappropriate actions)
Game Involvement (GI)	No. of appropriate actions / (No. of appropriate actions + No. of inappropriate actions)
Game Performance (GP)	(DMI + SEI + SAI + GMI) / 4

Data Analysis and Processing

All statistical analyses were conducted using IBM SPSS Statistics (version 29), and Microsoft Excel was used for the initial organization and systematization of the data. Descriptive statistics were reported as mean $\pm$ standard deviation, with 95% confidence intervals, and included the absolute delta (Δ = Posttest – Pretest) and the percentage change delta ($\Delta\%$ = [(Post – Pre) / Pre] $\times$ 100) to characterize each group’s change across assessment points. Data normality was assessed using the Shapiro–Wilk test, as it is appropriate for small

samples, and homogeneity of variances was examined using Levene's test, confirming the assumptions required for parametric testing.

For within-group comparisons (pre- vs. post-intervention), paired-samples *t* tests were used. Between-group analyses were performed using independent-samples *t* tests to compare groups on the study variables. Statistical significance was set at $p < 0.05$, and results with $p \geq 0.05$ were considered not statistically significant. In addition, effect size was calculated using Cohen's *d* to evaluate the practical magnitude of the observed differences. Values of *d* were interpreted as trivial ($d < 0.20$), small ($0.20 \leq d < 0.50$), medium ($0.50 \leq d < 0.80$), large ($0.80 \leq d < 1.30$), and very large ($d \geq 1.30$). Collectively, these procedures allowed analysis not only of statistically significant differences but also of their practical relevance, ensuring rigor and consistency in the interpretation of results.

Results

Descriptive Analysis

Table 4 presents the descriptive statistics for the GPAI variables for the GCF and GPCF groups at the initial (baseline) and final assessment points. It also includes the absolute change (Δ), representing the difference between final and initial assessments, as well as the relative percentage change ($\Delta\%$), indicating the proportional magnitude of this difference relative to the baseline value.

Table 4: Descriptive statistics for the GPAI variables for the two groups in the sample.

Variables	Groups							
	GCF				GPCF			
	IA	FA	Δ	$\Delta\%$	IA	FA	Δ	$\Delta\%$
DMI	0.46 ± 0.21	0.70 ± 0.17	0.24	52.05	0.61 ± 0.24	0.74 ± 0.20	0.13	21.24
SEI	0.58 ± 0.14	0.63 ± 0.09	0.05	8.26	0.48 ± 0.19	0.68 ± 0.23	0.20	42.86
SAI	0.53 ± 0.10	0.67 ± 0.13	0.14	26.50	0.52 ± 0.13	0.76 ± 0.11	0.24	45.04
GMI	0.32 ± 0.13	0.37 ± 0.19	0.04	13.71	0.42 ± 0.24	0.35 ± 0.24	- 0.07	- 16.23
GI	96.71 ± 27.60	117.57 ± 27.59	20.86	21.56	87.17 ± 9.35	87.17 ± 6.24	0.00	0.00
GP	0.47 ± 0.09	0.59 ± 0.10	0.12	25.11	0.51 ± 0.14	0.63 ± 0.12	0.13	24.61

Legend: DMI = Decision-Making Index; SEI = Skill Execution Index; SAI = Support Actions Index; GMI = Guarding/Marking Index; GI = Game Involvement; GP = Game Performance; IA = Initial Assessment; FA = Final Assessment; Δ = change between the post and pre time points; $\Delta\%$ = percentage change between the post and pre time points.

Between-Group Analysis

Table 5 presents the comparison between the two groups at the Initial Assessment. No statistically significant differences were found between groups for any of the variables analyzed, as all *p* values were greater than 0.05. This is further supported by the small *t*-test values and by Cohen's *d* effect sizes, which in most cases were classified as trivial, small, or medium. These findings indicate that, at the Initial Assessment, the groups showed similar performance, with no statistically significant differences in any of the GPAI indices analyzed, confirming the expected baseline homogeneity between groups.

Table 5: Between-group comparison at the Initial Assessment.

Variables	IA GCF	IA GPCF	<i>t</i>	Δ	<i>p</i>	<i>d</i>	ES
DMI	0.46 ± 0.21	0.61 ± 0.24	- 1.21	0.15	0.252	0.69	Medium
SEI	0.58 ± 0.14	0.48 ± 0.19	1.14	- 0.11	0.277	- 0.64	Medium
SAI	0.53 ± 0.10	0.52 ± 0.13	0.11	- 0.01	0.913	- 0.07	Trivial
GMI	0.32 ± 0.13	0.42 ± 0.24	- 0.92	0.10	0.377	0.50	Medium
GI	96.71 ± 27.60	87.17 ± 9.35	0.86	- 9.55	0.438	- 0.45	Small
GP	0.47 ± 0.09	0.51 ± 0.14	- 0.52	0.03	0.617	0.29	Small

Legend: GCF = Corrective Feedback Group; GPCF = Positive + Corrective Feedback Group; DMI = Decision-Making Index; SEI = Skill Execution Index; SAI = Support Actions Index; GMI = Guarding/Marking Index; GI = Game Involvement; GP = Game Performance; IA = Initial Assessment; *t* = *t*-test value; Δ = mean difference; *p* = *p*-value; *d* = Cohen's *d*; ES = effect size magnitude.

Table 6 presents the between-group comparison at the Final Assessment (FA). A statistically significant difference was observed only for GI ($p = 0.02$), with the GCF showing a higher mean value than the GPCF ($\Delta = - 30.40$) and a large effect size ($d = -1.29$). For the remaining variables (DMI, SEI, SAI, GMI, and GP), no statistically significant differences were found ($p > 0.05$), with effect sizes ranging from trivial to medium; notably, SAI showed a medium effect ($d = 0.73$). From a descriptive standpoint, the GPCF presented higher mean values than the GCF for DMI, SEI, SAI, and GP, whereas the GCF showed higher values for GI and GMI.

However, except for GI, these differences did not reach statistical significance and should be interpreted with caution given the sample size and the observed variability.

Table 6: Between-group comparison at the Final Assessment (FA).

Variables	FA GCF	FA GPCF	t	Δ	p	d	ES
DMI	0.70 $\pm$ 0.17	0.74 $\pm$ 0.20	-0.37	0.04	0.722	0.20	Small
SEI	0.63 $\pm$ 0.09	0.68 $\pm$ 0.23	-0.52	0.05	0.593	0.27	Small
SAI	0.67 $\pm$ 0.13	0.76 $\pm$ 0.11	-1.30	0.09	0.220	0.73	Medium
GMI	0.37 $\pm$ 0.19	0.35 $\pm$ 0.24	0.12	-0.01	0.908	-0.07	Trivial
GI	117.57 $\pm$ 27.59	87.17 $\pm$ 6.24	2.63	-30.40	0.024	-1.29	Large
GP	0.59 $\pm$ 0.10	0.63 $\pm$ 0.12	-0.68	0.04	0.514	0.36	Small

Legend: GCF = Corrective Feedback Group; GPCF = Positive + Corrective Feedback Group; DMI = Decision-Making Index; SEI = Skill Execution Index; SAI = Support Actions Index; GMI = Guarding/Marking Index; GI = Game Involvement; GP = Game Performance; IA = Initial Assessment; FA = Final Assessment; t = t-test value; Δ = mean difference; p = p-value; d = Cohen's d; ES = effect size magnitude.

Within-Group Analysis

In Table 7, the data show that, even without the use of positive feedback, students in the GCF demonstrated statistically significant improvements in four core variables of game performance: DMI ($p = 0.02$; $\Delta = 0.24$; $d = 1.26$, large), SAI ($p < 0.001$; $\Delta = 0.14$; $d = 1.21$, large), and GP ($p = 0.02$; $\Delta = 0.12$; $d = 1.27$, large). These results point to substantial learning gains in fundamental technical-tactical components. GI also showed a significant improvement ($p = 0.02$; $\Delta = 20.86$; $d = 0.76$, medium), reflecting greater involvement in game tasks. In contrast, SEI ($p = 0.49$; $\Delta = 0.05$; $d = 0.38$, small) and GMI ($p = 0.53$; $\Delta = 0.04$; $d = 0.27$, small) showed modest, non-significant improvements, suggesting more limited progress in these domains.

Table 7: Results of the GCF's progression based on the paired-samples t test.

Variables	IA GCF	FA GCF	t	Δ	p	d	ES
DMI	0.46 $\pm$ 0.21	0.70 $\pm$ 0.17	-3.09	0.24	0.021	1.26	Large
SEI	0.58 $\pm$ 0.14	0.63 $\pm$ 0.09	-0.74	0.05	0.485	0.38	Small
SAI	0.53 $\pm$ 0.10	0.67 $\pm$ 0.13	-5.81	0.14	0.001	1.21	Large
GMI	0.32 $\pm$ 0.13	0.37 $\pm$ 0.19	-0.66	0.05	0.534	0.27	Small
GI	96.71 $\pm$ 27.60	117.57 $\pm$ 27.59	-3.03	20.86	0.023	0.76	Medium
GP	0.47 $\pm$ 0.09	0.59 $\pm$ 0.10	-3.27	0.12	0.017	1.27	Large

Legend: GCF = Corrective Feedback Group; GPCF = Positive + Corrective Feedback Group; DMI = Decision-Making Index; SEI = Skill Execution Index; SAI = Support Actions Index; GMI = Guarding/Marking Index; GI = Game Involvement; GP = Game Performance; IA = Initial Assessment; FA = Final Assessment; p = p-value; d = Cohen's d; ES = effect size magnitude.

The analysis of Table 8 indicates that the GPCF showed statistically significant improvements in three key variables: SAI ($p = 0.01$; $\Delta = 0.24$; $d = 1.98$, very large), SEI ($p = 0.03$; $\Delta = 0.20$; $d = 0.98$, large), and GP ($p < 0.001$; $\Delta = 0.13$; $d = 0.98$, large). These findings support the effectiveness of pedagogical feedback in promoting technical, tactical, and overall performance development within the Physical Education context. DMI also improved, although this change did not reach statistical significance ($p = 0.08$; $\Delta = 0.13$; $d = 0.60$, medium), suggesting a potential positive but less consistent effect.

In contrast, GI remained unchanged ($p = 1.00$; $\Delta = 0.00$; $d = 0.00$, trivial), and GMI showed a slight decline ($p = 0.33$; $\Delta = -0.07$; $d = -0.29$, small), which may indicate areas in which feedback had a lesser impact or that may require methodological adjustments.

Table 8: Results of the GPCF's progression based on the paired-samples t test.

Variables	IA GPCF	FA GPCF	t	Δ	p	d	ES
DMI	0.61 $\pm$ 0.24	0.74 $\pm$ 0.20	-2.25	0.13	0.075	0.60	Medium
SEI	0.48 $\pm$ 0.19	0.68 $\pm$ 0.23	-3.00	0.20	0.030	0.98	Large
SAI	0.52 $\pm$ 0.13	0.76 $\pm$ 0.11	-4.69	0.24	0.005	1.98	Very Large
GMI	0.42 $\pm$ 0.24	0.35 $\pm$ 0.24	1.09	-0.07	0.332	-0.29	Small
GI	87.17 $\pm$ 9.35	87.17 $\pm$ 6.24	0.00	0.00	1.000	0.00	Trivial
GP	0.51 $\pm$ 0.14	0.63 $\pm$ 0.12	-5.87	0.13	0.002	0.98	Large

Legend: GCF = Corrective Feedback Group; GPCF = Positive + Corrective Feedback Group; DMI = Decision-Making Index; SEI = Skill Execution Index; SAI = Support Actions Index; GMI = Guarding/Marking Index; GI = Game Involvement; GP = Game Performance; IA = Initial Assessment; FA = Final Assessment; p = p-value; d = Cohen's d; ES = effect size magnitude.

Discussion

The present study aimed to examine the influence of the systematic use of combined positive and corrective feedback on secondary school students' technical-tactical performance in basketball. Based on the hypothesis that the Positive + Corrective Feedback Group (GPCF) would demonstrate greater improvements than the Corrective Feedback Group (GCF), the study analyzed the impact of the intervention on six variables from the Game Performance Assessment Instrument: Decision Making, Skill Execution, Support Actions, Guarding/Marking, Game Involvement, and Game Performance. The results did not confirm the initial hypothesis. Specifically, both groups improved from the initial to the final assessment. In the between-group comparison at the Final Assessment, no statistically significant differences were observed for most variables, except for Game Involvement (GI), for which the GCF showed higher values than the GPCF ($p < 0.05$), suggesting that the effects of feedback were not uniform across performance indicators.

Although both groups demonstrated improvements from pretest to posttest, between-group comparisons did not reveal statistically significant differences for most variables ($p > 0.05$), except for GI at the Final Assessment. This lack of significance may indicate that, in the short term, the added effect of positive feedback (beyond corrective feedback) did not consistently translate into statistically detectable advantages across most indicators. It is also important to note that, at the Initial Assessment, no statistically significant differences were found between groups, indicating comparable baseline conditions and allowing subsequent changes to be interpreted with greater confidence. Nevertheless, because the GCF received corrective feedback throughout the unit, the contrast between conditions was reduced, potentially attenuating between-group differences and limiting the detection of any additional effects of positive feedback.

However, the presence of higher mean values in the GPCF across several variables (despite being non-significant) suggests a potential pattern favoring combined feedback, which should be interpreted descriptively rather than confirmatory. This pattern is consistent with authors such as Brookhart (2008) and Hattie and Timperley (2007), who note that feedback effects often emerge gradually, requiring time, repetition, and opportunities for reflection. In addition, it is possible that, at certain moments, feedback emphasized outcomes more than processes, although this dimension was not quantified in the present study. According to Rink (2010) and Wulf and Lewthwaite (2016), process-focused feedback, because it emphasizes strategies and decision-making—tends to produce more meaningful and durable learning. From this perspective, the absence of consistent between-group differences may reflect not only the presence or absence of positive feedback, but also the extent to which the feedback content was aligned with task goals and the learners' stage of skill acquisition.

The within-group analysis was more informative. In the GCF, a pattern of significant improvement was observed in Decision Making ($p = 0.02$), Support Actions ($p = 0.002$), Game Involvement ($p = 0.02$), and Game Performance ($p = 0.02$). These results indicate that regular practice, even under a more restricted feedback condition (corrective and task-focused), was sufficient to produce gains, particularly in tactical components. This effect may be related to task repetition and students' increasing familiarity with small-sided game contexts, as suggested by Renshaw et al. (2016) and Memmert and Harvey (2008). However, it is not possible to determine whether these improvements resulted from greater tactical understanding and reflection or, in part, from repetition effects and adaptation to the small-sided format; therefore, this aspect should be interpreted cautiously. In the GPCF, statistically significant improvements were also observed, with large to very large effects, in Skill Execution ($p = 0.03$), Support Actions ($p = 0.01$), and Game Performance ($p < 0.001$). These findings suggest that positive feedback, combined with corrective feedback, may have contributed to improvements in technical skills, tactical collaboration, and overall performance. Although Decision Making did not reach statistical significance ($p = 0.08$), the observed medium effect size indicates a positive trend that should not be dismissed, especially in small-sample contexts.

However, for variables such as Guarding/Marking and Game Involvement, the GPCF results were trivial or even slightly negative, suggesting limitations in the effectiveness of feedback for these dimensions. In the case of GI, it is important to note that this indicator may be influenced not only by the quality but also by the quantity of actions or participation in the game, potentially reflecting shifts in participation dynamics and risk-taking. Thus, an emphasis on precision and control in feedback could have reduced the frequency of attempts/actions for some students, without necessarily indicating poorer overall technical-tactical quality. Alternatively, feedback may have increased selectivity of actions (fewer initiatives but potentially better-adjusted ones), which could reduce GI without compromising other dimensions such as SEI, SAI, or GP. Such limitations may be associated with how feedback was delivered, its contextual relevance, or students' ability to integrate it into game situations (Khalifa et al., 2021).

The integration of positive and corrective feedback showed more consistent indications in dimensions associated with execution and overall performance, suggesting that combined feedback may be particularly useful when targeted to observable aspects that can be adjusted immediately. This interpretation aligns with research by Hattie and Timperley (2007), who emphasize the role of feedback in promoting self-regulation and reflection, and by Renshaw et al. (2016), who highlight the contribution of intrinsic motivation and a process focus. Nevertheless, some GPAI indicators may be especially sensitive to the game context and the computation method; therefore, interpretation should consider direction of effects, magnitude (d), and consistency across variables.

At the same time, the absence of clear effects on some variables in the GPCF highlights that feedback outcomes are strongly dependent on their type, timing, and quality. As Partington and Cushion (2013) argue, feedback effectiveness depends not only on whether feedback is provided, but also on how well it fits the pedagogical context, students' characteristics, and task demands; moreover, overly frequent or intrusive feedback may limit students' autonomy and reduce potential learning benefits. Additionally, because feedback parameters were not systematically recorded, it is not possible to determine whether the lack of between-group differences resulted from a limited effect of positive feedback per se or from variability in the feedback delivered across lessons. This issue is particularly relevant given evidence that feedback frequency and precision can shape motor learning, while the optimal timing, frequency, and duration of feedback remain unclear, reinforcing the need for more consistent methodological reporting (Petancevski et al., 2022).

Although the results did not confirm the initial hypothesis in the between-group comparisons, several limitations should be acknowledged. The small sample size ($n = 13$) and the use of a single school context limit generalizability and reduce statistical power to detect differences between conditions. Moreover, the intervention duration may have been insufficient to promote deeper changes, particularly in complex tactical dimensions such as defensive behaviors. Furthermore, because both groups engaged in systematic small-sided game practice and received corrective feedback (albeit with different emphases), improvements may have occurred in both groups while simultaneously reducing the contrast between conditions. Finally, feedback was not systematically recorded in terms of content, timing, frequency, or duration, which limits insight into the mechanisms underlying the observed effects, and it should be recognized that interactions among feedback variables (e.g., timing, frequency, and type) may depend on context and task characteristics (Petancevski et al., 2022).

Even so, the pretest-posttest design in an authentic teaching context, together with the within-group analyses, enabled a sensitive examination of change across the instructional unit, suggesting improvements in the GPCF for Skill Execution, Support Actions, and Game Performance, despite the absence of consistent between-group differences for most indicators. Beyond statistical significance, interpretation was supported by effect magnitudes and change metrics; therefore, these findings should be viewed as preliminary evidence and warrant replication with larger samples, longer intervention periods, and systematic monitoring of feedback type and "dose." From a pedagogical perspective, the results support the judicious and context-sensitive use of feedback, prioritizing brief, process-oriented cues, immediate opportunities for reattempts, and short moments of guided reflection, thereby fostering a more reflective, motivating, and meaningful learning environment.

Conclusions

The primary aim of this study was to analyze the effects of the systematic implementation of combined positive and corrective feedback on secondary school students' technical-tactical performance in basketball. Specifically, the study examined how distinct feedback conditions influence students' progression in key competencies such as decision making, skill execution, and overall game performance.

Based on the statistical and interpretive analyses, no statistically significant between-group differences were observed for most of the variables examined. However, at the Final Assessment, a statistically significant difference was found for Game Involvement (GI) ($p < 0.05$), with higher values in the Corrective Feedback Group (GCF). Nevertheless, the results indicate that both groups improved over the course of the instructional unit, showing gains across several GPAI variables.

In the Positive + Corrective Feedback Group (GPCF), statistically significant improvements were observed in Skill Execution, Support Actions, and Game Performance, suggesting that the integration of positive and corrective feedback may support technical learning and tactical collaboration. Although Decision Making did not reach statistical significance, the positive trend observed may indicate a potential benefit that could become more evident with longer interventions and larger samples.

The GCF also demonstrated improvements, particularly in tactical dimensions, underscoring the value of systematic practice and increasing familiarity with game-representative situations, even in the absence of a structured positive feedback component. This finding suggests that, beyond the presence of feedback alone, its quality, timing, and pedagogical relevance are critical for effectiveness, and that different performance dimensions may respond differently depending on the feedback condition implemented.

The main contribution of this study is that it highlights feedback as a pedagogical process whose effects depend not only on whether feedback is positive or corrective, but also on its specificity, timing, instructional purpose, and connection with the learning task. Therefore, the findings suggest that positive feedback should not be used merely as general praise, but as informative reinforcement that helps students recognize effective actions, maintain appropriate tactical behaviors, and transfer them to subsequent game situations.

From a practical perspective, PE teachers should use feedback deliberately and contextually, combining corrective information with positive reinforcement when appropriate, while ensuring that students understand what was performed effectively, what requires adjustment, and how they can improve in the next action. Brief, process-oriented feedback followed by immediate opportunities for reattempts and guided reflection may be especially relevant in team-sport units, where learning depends on the interaction between technical execution, tactical decision making, and game involvement.

Considering the study's limitations, particularly the small sample size, the short intervention duration, and the absence of systematic recording of feedback characteristics, these results should be interpreted as preliminary. Overall, both feedback conditions supported students' technical-tactical development, but the addition of positive feedback did not produce a clear and consistent advantage over corrective feedback alone within this short instructional unit. Future research should use larger samples, longer intervention periods, and systematic monitoring of feedback type, frequency, timing, content, specificity, duration, and mode of delivery. This would allow a clearer understanding of the "dose" and quality of feedback required to promote specific technical-tactical outcomes in PE. Further studies should also examine whether different combinations of positive, corrective, and reflective feedback produce distinct effects according to students' initial skill level, task characteristics, and game context.

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