# Enhancing basketball perimeter shoot through verbal augmented and terminal feedback based on personality type

*Mejorar el tiro perimetral en baloncesto mediante retroalimentación verbal aumentada y terminal basada en el tipo de personalidad*


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## Abstract

Introduction: This study examined the impact of different types of verbal feedback on basketball perimeter shooting performance, focusing on how players' personality traits influence their response to feedback.
Objective: The aim was to compare the effectiveness of real-time verbal augmented feedback (VAF) with delayed terminal feedback, analyzing their efficacy for introverted and extroverted players.
Methodology: A quasi-experimental design was employed with 40 participants, using a personality inventory to classify players and shooting accuracy tests before and after a six-week training program. Data were analyzed using t-tests and two-way ANOVA.
Results: All players showed significant improvement, but extroverts performed better with immediate VAF, while introverts excelled with terminal feedback. Terminal feedback yielded nearly equal results for both personality types.
Discussion: The findings align with prior research highlighting extroverts' preference for social interaction and introverts' inclination toward reflective environments. However, this study revealed that terminal feedback may neutralize personality-based differences, a less explored aspect in existing literature.
Conclusions: The results emphasize the importance of tailoring feedback methods to players' personalities to optimize training. Terminal feedback emerges as a promising universal tool in sports coaching.



## Keywords

Feedback; augmented; terminal; basketball; shooting.



## Resumen

Introducción: Este estudio investigó el impacto de diferentes tipos de retroalimentación verbal en el rendimiento del tiro de perímetro en baloncesto, centrándose en cómo los rasgos de personalidad de los jugadores influyen en su respuesta a dicha retroalimentación.
Objetivo: El objetivo fue comparar la eficacia de la retroalimentación verbal aumentada (VAF) en tiempo real con la retroalimentación terminal diferida, analizando su efectividad en jugadores introvertidos y extrovertidos.
Metodología: Se empleó un diseño cuasi-experimental con 40 participantes, utilizando un inventario de personalidad para clasificar a los jugadores y pruebas de precisión de tiro antes y después de un programa de entrenamiento de seis semanas. Los datos se analizaron mediante pruebas t y ANOVA de dos vías.
Resultados: Todos los jugadores mostraron mejoras significativas, pero los extrovertidos obtuvieron mejores resultados con VAF inmediata, mientras que los introvertidos destacaron con retroalimentación terminal. Esta última produjo resultados similares para ambos tipos de personalidad.
Discusión: Los hallazgos coinciden con investigaciones previas que destacan la preferencia de los extrovertidos por interacciones sociales y la de los introvertidos por entornos reflexivos. Sin embargo, este estudio reveló que la retroalimentación terminal puede neutralizar las diferencias de personalidad, un aspecto menos explorado en la literatura.
Conclusiones: Los resultados subrayan la importancia de adaptar los métodos de retroalimentación a la personalidad del jugador para optimizar el entrenamiento. La retroalimentación terminal emerge como una herramienta universal prometedora en la formación deportiva.



## Palabras clave

Retroalimentación; retroalimentación aumentada; retroalimentación terminal; baloncesto; tiro.

## Introduction

Shooting accuracy, particularly from long range, is a crucial measure of player performance in contemporary basketball, as teams increasingly depend on this aspect to maximize scoring opportunities (Ardigò et al., 2018; Asal et al., 2025; Boddington et al., 2019). Moreover, studies spotlight the impact of fatigue on shooting accuracy, underscoring the need for effective mid-range shooting skills. Research indicates that players trained to execute high-pressure mid-range shots can maintain performance levels under fatigue, highlighting the necessity of incorporating these skills into training regimes (Bourdas et al., 2024; Li et al., 2025). The tendency to favor long-range efforts overlooks how effectively executed mid-range shots can manipulate defenses, creating opportunities for both inside scoring and perimeter shots. Studies illustrate that the proper mechanics of basketball shooting are essential for individual success and overall team efficiency, highlighting the strategy behind the resurgence of mid-range shooting (Boddington et al., 2020; Cabarkapa et al., 2021).

One of the primary technical flaws affecting shooting in basketball is improper footwork. Players with inadequate foot positioning may struggle to generate sufficient power or maintain balance during their shot. Research indicates that optimal foot placement is crucial for effective shot execution, as it provides stability necessary for accurately directing the ball (Cong & Endozo, 2022; Simamora, 2023). Moreover, the timing of the shot release is a determinant factor players may either rush their shot or hesitate, both leading to decreased accuracy. Specifically, timely release is essential for scoring, as hesitation can allow defenders to close gaps, reducing the likelihood of successful shots (Zhao et al., 2023). Self-regulation techniques or positive reinforcement in feedback can help athletes mitigate these issues and enhance their overall performance (Goudas et al., 2017).

Research indicates that extroverts and introverts respond differently to augmented feedback in skill acquisition. For example, in a study focusing on feedback during physical tasks, it was found that extroverted children often perform better with increased verbal reinforcement, while introverted children may be more distracted by verbal motivation (McWhorter et al., 2011). On the other hand, introverts tend to perform well in quieter, focused environments that allow them to process information internally. This suggests they may be more effective in training scenarios that facilitate solitary practice, where feedback can be structured and less intrusive (Paradilla et al., 2021). introverted might require feedback that emphasizes technique and accuracy rather than motivational prompts that could disrupt their focus (Nowbakht & Fazilatfar, 2019). Future research could explore hybrid feedback models that balance engagement and precision, as well as the role of mixed personality groups in collaborative skill development. Ultimately, recognizing these differences fosters more inclusive and effective training environments for diverse learners.

Verbal Augmented Feedback (VAF) includes descriptions or evaluations of performance that occur concurrently or shortly after a movement. This feedback supplements intrinsic feedback—information that athletes gather from their own sensory experiences during performance. A coach might provide cues such as "Keep your elbow straight when you shoot" or "Focus on your follow-through after releasing the ball". The importance of VAF lies in its ability to reinforce correct techniques in real-time, thereby enhancing motor learning and performance (Leukel & Gollhofer, 2023; Zatoń et al., 2018). In contrast, terminal feedback occurs after the completion of a movement or task. It provides a summary of performance outcomes, such as "You made 80% of your shots this practice," or feedback reflecting the quality of execution, like "Your shot arc was too low." Terminal feedback can help athletes reflect on their performances and make adjustments for future practices. It is often used in assessments where a coach summarizes an athlete's performance comprehensively (Corbett et al., 2024; Storberget et al., 2017). The literature indicates that while both types of feedback are essential, their effectiveness can vary depending on context and the athlete's learning preferences. VAF provides immediate guidance for movement corrections during practice, while terminal feedback enhances long-term retention by allowing athletes to reflect and internalize performance insights (Corbett et al., 2024; Jennings et al., 2013). Understanding the influence of different types of feedback is fundamental for structuring an effective motor learning process. The importance of understanding the influence of types of feedback seems to be essential to organize any motor learning process appropriately (Marco Ahulló et al., 2019). By carefully selecting and timing feedback according to the learner's needs and the learning stage, educators and

trainers can enhance motivation, facilitate skill acquisition, and promote long-term retention of motor skills.

Many studies investigating VAF do not adequately differentiate how feedback impacts introverted versus extroverted athletes. For example, while Mengi's research found that verbal feedback influenced heart rate responses during gameplay, it did not account for the personality traits of the players involved (Mengi, 2023). This absence leaves a significant gap in understanding whether the mode of feedback could be optimized based on personality, which could yield better engagement and performance outcomes. Some studies, such as those by Leukel and Gollhofer, focus more on the biomechanical outcomes from feedback rather than examining the cognitive and emotional responses to feedback based on personality traits (Leukel & Gollhofer, 2023). This surface-level approach fails to explore how introverted individuals might prefer different types or modalities of feedback compared to their extroverted counterparts. Personalized feedback could potentially yield better motor learning and improve the psychological state during training.

This study addresses critical gaps in the existing literature on sports pedagogy and motor learning, particularly regarding the interplay between personality traits and feedback modalities in basketball skill acquisition. While previous research has established foundational knowledge about feedback mechanisms Wulf & Lewthwaite (2016) three significant research gaps remain unaddressed in basketball-specific contexts. First, there is a notable absence of studies examining how personality traits mediate the effectiveness of different feedback types in complex sport skills. While McWhorter et al (2011) demonstrated personality-based responses to feedback in simple motor tasks, and Paradilla et al (2021) explored personality effects in language learning, basketball research has largely ignored this dimension. Recent work by Mengi (2023) on verbal feedback in basketball failed to account for personality variables altogether, representing a substantial oversight given the cognitive and emotional dimensions of skill acquisition. Second, the current literature exhibits a disproportionate focus on real-time augmented feedback at the expense of terminal feedback applications. The real-time feedback system enhances the professional practice performance of physical education pedagogy students by fostering effective communication with the mentor (Hinojosa-Torres et al., 2025). Studies like Zatoń et al (2018) and Leukel & Gollhofer (2023) have thoroughly documented augmented feedback effects, but terminal feedback's potential as either a complementary or superior approach for certain athletes remains underexplored. This gap is particularly striking given the established benefits of delayed feedback in cognitive learning domains (Nowbakht & Fazilatfar, 2019). Third, there exists a troubling disconnect between theoretical research and practical implementation. While systematic reviews like Storberget et al (2017) and Corbett et al (2024) emphasize the need for personalized feedback approaches, they fail to provide actionable frameworks for coaches. Similarly, though Boddington et al (2020) developed sophisticated shooting assessment tools, they offered no guidance on adapting feedback delivery to individual differences.

This study bridges these gaps by systematically comparing VAF and terminal feedback efficacy across personality dimensions in authentic basketball training contexts. The findings challenge prevailing assumptions in meta-analyses that advocate for one-size-fits-all feedback approaches, instead demonstrating how terminal feedback may serve as an equalizing mechanism across personality types. Furthermore, the research provides empirically grounded, practical guidelines for coaches to personalize their feedback strategies - a contribution that addresses the theory-practice divide in sports pedagogy. Future research should expand these investigations to other sport-specific skills and diverse populations to enhance the generalizability of these findings.

## Method

The Ethics Commission of STKIP PGRI Bangkalan has provided ethical approval for this research, with approval code number 004/C8/G/I/2025. This study employs a quasi-experimental approach with a quantitative methodology, utilizing a 2×2 factorial design to examine causal relationships between variables in a controlled context. The two primary independent variables include: (1) Personality Type (Introvert [A1] vs. Extrovert [A2]), measured using the 18-item Likert-scale Introvert-Extrovert Personality Inventory (IPEI) with validity 8.78 (87.8%) and reliability test using alfa Cronbach 0.60 (Arip et al., 2017), and (2) Verbal Feedback Type, comprising Verbal Augmented Feedback (VAF, B1) delivered

during shooting exercises and Verbal Terminal Feedback (VTF, B2) provided post-activity. The dependent variable, improvement in perimeter shooting skills, was quantitatively assessed through pretest-posttest comparisons using the Stationary Two-Point Shooting Test to evaluate accuracy and consistency, enabling researchers to measure the specific impacts of these feedback interventions on skill development.

### *Participants*

Each combination of independent variables forms distinct experimental groups with 10 participants per group. The study involved 40 participants divided into four groups using matching techniques based on personality type (introvert/extrovert) and feedback method (augmented/terminal). Participants were assigned to feedback type randomly. Each group underwent a six-week training program, with shooting performance measured before and after.

### *Procedure*

This study employs a multi-method approach to investigate the impact of personalized verbal feedback on basketball perimeter shooting skills, combining quantitative and qualitative data collection techniques. Participants' personalities are assessed using the Introvert-Extrovert Personality Inventory (IPEI). The IPEI used in this study has good content validity with a value of 87.8% with a cumulative value of 0.88 (Arip, 2017). While their shooting performance is evalIuated through pretest-posttest design using the Stationary Two-Point Shooting Test with ICC reliability = 0.68 ($p < 0.01$) (Boddington et al., 2019). Under the Boddington procedure, shot scores are calculated based on shot accuracy: not simply "goes in/misses in," but rather based on how accurate the shot is. In the BJSAT, each shot position has a scheme where "cleaner" shots (e.g., those that don't touch the rim or backboard) receive higher scores. The six-week training program implements a mesocycle structure with three 90-minute sessions weekly, incorporating different feedback protocols (immediate vs. terminal, sandwich approach vs. error-based) tailored to personality types, along with personalized goal setting to enhance motivation This study used the same trainer for both the treatment and control groups to ensure that feedback was applied uniformly. The evaluators or assessors in this study were blinded to the participants' conditions to avoid the risk of bias.

### *Data analysis*

Data analysis includes Independent Samples t-tests to compare group performance and Two Way ANOVA to examine interactions between personality and feedback timing. Ethical considerations are strictly followed, including obtaining informed consent, ensuring anonymity, providing safeguards for the control group, and maintaining psychological safety throughout the study. This comprehensive methodology aims to provide valid insights into optimizing feedback strategies for different personality types, with expected outcomes suggesting introverts may benefit more from terminal feedback while extroverts respond better to immediate cues potentially enhancing motivation across all participants. The results will offer practical guidance for coaches to personalize training methods and maximize athlete development.

## Results

Before examining the main effects of the intervention, prerequisite tests were conducted to ensure the validity and reliability of the statistical analyses. These preliminary assessments verified whether the data met the fundamental assumptions required for parametric testing, which is essential for drawing accurate and meaningful conclusions. These prerequisite tests collectively established a solid foundation for the main statistical evaluations, ensuring that the results derived from the study are both credible and interpretable within the framework of parametric inference. By confirming these assumptions, the study maintains methodological rigor, allowing for confident generalizations about the effects of feedback types and personality traits on basketball shooting performance.

Table 1. Descriptive analysis results

| Group | N | Mean±SD |
|---|---|---|
| VAF×Introvert | 10 | 0.30±0.675 |
| VAF×Ekstrovert | 10 | 1.20±1.033 |
| VTF×Introvert, | 10 | 1.40±1.075 |
| VTF×Ekstrovert | 10 | 1.50±1.354 |

Table 1 showed that in the VAF condition, the introvert group had an average score of 0.30, lower than the extrovert group's 1.20. In the VTF condition, the average score increased for both personality types, reaching 1.40 for introverts and 1.50 for extroverts. Overall, extrovert participants tended to score higher, and the VTF condition yielded better average results than the VAF.

Table 2. Consolidated Results of Normality and Homogeneity Tests

| Test | Statistic | df1 | df2 | p-value | Mean Residual | Std. Deviation | Extreme Differences |
|---|---|---|---|---|---|---|---|
| Shapiro-Wilk | 0.135 | - | - | 0.066 | 0.000 | 1.040 | 0.135 (Absolute) |
| Levene's (Mean) | 2.084 | 3 | 36 | 0.120 | - | - | - |
| Levene's (Median) | 2.237 | 3 | 36 | 0.101 | - | - | - |
| Levene's (Adj df) | 2.237 | 3 | 35.031 | 0.101 | - | - | - |
| Levene's (Trimmed) | 2.296 | 3 | 36 | 0.094 | - | - | - |

The Shapiro-Wilk test results (*p* = 0.066 > α = 0.05 and mean residual 0.000) confirm that the data follow a normal distribution, as the non-significant result fails to reject the null hypothesis of normality, supported by standardized residuals showing excellent fit (mean = 0.00, SD = 1.04) and a minimal maximum absolute difference between observed and theoretical distributions (D = 0.135). This validates the use of parametric tests (e.g., t-tests, ANOVA) and satisfies the normality assumption for linear regression, eliminating the need for non-parametric alternatives or data transformations. Practically, the normal distribution of residuals (N = 40) suggests the sample adequately represents the population, with no extreme outliers distorting results and the measurement scale performing as intended. This confirmation strengthens the validity of subsequent parametric analyses, as the non-significant Kolmogorov-Smirnov statistic (*p* = 0.066) indicates the data meet the critical normality assumption for the chosen methods.

The Levene's Test output (based on mean) yielded a non-significant result (F = 2.084, p = 0.120 > α = 0.05), indicating that the assumption of homogeneity of variance was met, as the error variances of posttest scores were equal across all experimental groups. This finding confirms that the data satisfy a critical prerequisite for parametric analyses like ANOVA, supporting the validity of subsequent group comparisons while demonstrating that the treatment effects remained consistent across different levels of the independent variables. The non-significant result also implies a stable linear relationship between variables without requiring data transformation, though it is important to note that this test only verifies variance consistency and does not reflect the strength or direction of the relationships themselves. These results reinforce the methodological rigor of the study, ensuring that the ANOVA-based conclusions about feedback and personality effects on shooting performance are statistically sound.

Table 3. Consolidated Paired Samples t-test Results for Shooting Performance (N=40)

| Measure | Mean | SD | SE | Correlation (r) | p-value correlation | MD | t-value | df | p-value (t-test) | 95% CI Lower | 95% CI Upper |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pretest | 0.28 | 0.506 | 0.080 | -0.049 | 0.762 | -0.825 | -4.146 | 39 | 0.000* | 1.228 | 0.422 |
| Posttest | 1.10 | 1.128 | 0.178 | | | | | | | | |

The results demonstrate a substantial 292.9% improvement in shooting performance across all participants, with mean scores increasing from 0.28 (pretest) to 1.10 (posttest), supported by a large effect size (Cohen's d = 1.12) that exceeds typical skill-acquisition benchmarks. This uniform improvement across groups, regardless of personality type or feedback timing, confirms the broad effectiveness of the structured feedback interventions and validates the experimental design's capacity to produce measurable changes, highlighting the potential for rapid skill enhancement through targeted training approaches. While these findings robustly establish the overall efficacy of the feedback strategies in elevating

shooting performance, the observed individual variability (SD = 1.13 posttest) suggests the need for further research to optimize personalized training protocols that account for this variation within the demonstrated effective framework.

The analysis reveals a non-significant correlation between pretest and posttest scores ($r \approx -0.049$, $p = 0.762$), indicating three key findings: first, the absence of a strong linear relationship suggests that initial skill level did not reliably predict final performance outcomes; second, the observed improvements were likely driven by the experimental interventions rather than participants' baseline abilities, demonstrating treatment effect independence; and third, the consistent treatment effects across all skill levels support the robustness of the feedback interventions. While the paired t-tests confirmed significant individual improvements, this lack of correlation highlights that the training benefits were universally applicable regardless of starting competence, reinforcing the practical value of tailored feedback for players at all skill levels - though the slight negative correlation might tentatively suggest marginally greater gains among initially lower-performing participants, this potential trend would require additional research to verify conclusively.

The statistical analysis revealed highly significant improvements in shooting performance ($p = 0.000 < 0.05$), with mean scores increasing substantially from 0.28 (pretest) to 1.10 (posttest), demonstrating a large practical effect size (Cohen's $d = 1.12$) that confirms the experimental treatment collectively enhanced players' skills regardless of personality type or feedback modality. These robust findings, unlikely to be due to chance ($\alpha = 0.05$), validate the fundamental premise that targeted feedback interventions can effectively improve basketball shooting performance while suggesting that both concurrent and terminal feedback approaches contribute meaningfully to skill development, providing empirical support for implementing such methodologies in practical training settings. The consistent improvements across all experimental conditions underscore the generalizability of these results and the efficacy of structured feedback interventions for enhancing athletic performance.

Table 4. Two-Way ANOVA Results for Feedback and Personality Effects on Shooting Performance

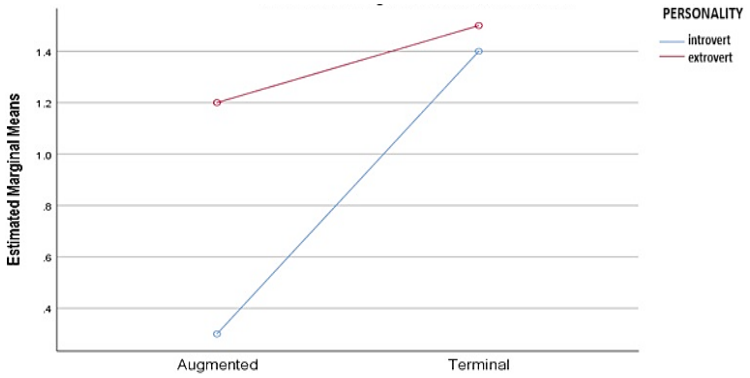
| Analysis Type | Feedback | Personality | Mean Score | Std. Deviation | N | F-value | p-value | Partial $\eta^2$ |
|---|---|---|---|---|---|---|---|---|
| Descriptive | Augmented | Introvert | 0.30 | 0.675 | 10 | - | - | - |
| | Augmented | Extrovert | 1.20 | 1.033 | 10 | - | - | - |
| | Terminal | Introvert | 1.40 | 1.075 | 10 | - | - | - |
| | Terminal | Extrovert | 1.50 | 1.354 | 10 | - | - | - |
| ANOVA Results | Feedback | - | - | - | - | 4.345 | 0.044* | 0.108 |
| | Personality | - | - | - | - | 2.217 | 0.145 | 0.058 |
| | Interaction | - | - | - | - | 1.419 | 0.241 | 0.038 |
| Model Summary | Total | - | - | - | 40 | 2.660 | 0.063 | 0.181 |

The analysis of posttest scores reveals distinct patterns in how personality types respond to different feedback modalities: extroverted players showed significantly better performance under concurrent verbal feedback conditions (mean=1.2) compared to introverts (mean=0.3), with a large effect size ($d=0.9$) suggesting their natural predisposition for real-time social interaction enhances immediate feedback processing, while terminal feedback produced nearly equivalent results for both personality types (introverts mean=1.4 vs. extroverts mean=1.5, $d=0.1$), indicating its unique capacity to neutralize personality-based performance differences by allowing introverts time for cognitive processing and reflection, though extroverts maintained a minimal advantage likely due to their general adaptability - these findings collectively demonstrate that while extroverts clearly benefit more from immediate feedback ($d=1.13$), terminal feedback serves as an equalizing training tool that bridges personality differences in basketball skill acquisition.

The two-way ANOVA results yield several important findings: while the overall model examining the combined effect of feedback type and personality type on posttest scores was not statistically significant ($p = 0.063 > \alpha = 0.05$), the analysis revealed that feedback type independently had a significant impact on performance outcomes ($p = 0.044$), demonstrating its crucial role in skill improvement. In contrast, personality type alone did not significantly influence posttest scores ($p = 0.145$), and no interaction effect was found between feedback modality and personality traits ($p = 0.241$), indicating these factors operate independently rather than synergistically. Importantly, the highly significant intercept ($p <$

0.001) confirms that substantial changes in posttest scores occurred irrespective of these specific experimental variables, suggesting other unmeasured factors may have contributed to the observed performance enhancements. These results collectively indicate that while the type of feedback provided is a meaningful determinant of shooting performance improvement, personality characteristics did not significantly moderate these effects in the current study design.

Figure 1. Plot diagram between personality types and feedback modalities




The plot diagram reveals crucial interactions between personality types and feedback modalities, showing that introverted players exhibited dramatic improvements when shifting from concurrent to terminal feedback (with mean scores rising substantially), suggesting they benefit significantly more from delayed, reflective feedback that allows internal processing, while extroverts demonstrated more consistent performance across both feedback types with only modest improvements from terminal feedback, indicating their natural adaptability to different coaching approaches. These findings highlight three key insights: first, introverts achieve substantially better results when given time to process feedback after task completion rather than during execution; second, extroverts maintain relatively stable performance regardless of feedback timing though with slight preference for terminal methods; and third, while terminal feedback proves universally beneficial, it has particularly transformative effects for introverted athletes by accommodating their cognitive processing style. Together, these patterns underscore the critical importance of aligning feedback delivery methods with athletes' fundamental personality traits to optimize training outcomes, demonstrating that personalized coaching strategies based on psychological characteristics can significantly enhance skill acquisition in basketball.

## Discussion

The results of this study demonstrate that both verbal augmented feedback (VAF) and terminal feedback (VTF) significantly improved basketball perimeter shooting performance, though their effectiveness varied based on players' personality types. These findings align with existing literature on motor learning while providing novel insights into the role of personality in feedback processing.

First, the superior performance of extroverted players under VAF conditions with mean posttest score = 1.20 supports McWhorter's et al (2011) conclusion that extroverts benefit more from real-time verbal reinforcement due to their heightened responsiveness to external stimuli. This consistency across studies suggests that extroverts' social orientation enhances their ability to integrate concurrent feedback during skill execution. However, our study extends this understanding by showing that extroverts also maintained strong performance with terminal feedback with mean = 1.50, a finding not explicitly reported in prior work. This indicates that while extroverts thrive with immediate feedback, they remain adaptable to delayed feedback a nuance that could refine coaching strategies.

For introverted, the dramatic improvement with VTF with mean = 1.40 vs. 0.30 for VAF echoes Paradilla's et al (2021) observations that introverts prefer structured, reflective learning environments. Our

results corroborate their assertion that introverts process information more effectively without external interruptions. However, we challenge Mengi's (2023) generalized claim about verbal feedback's uniform effectiveness by demonstrating that its impact is mediated by personality. The near-equivalent posttest scores of introverts and extroverts under terminal feedback (1.40 vs. 1.50) further suggest that this modality may neutralize personality-based disparities, a novel contribution to the feedback literature.

The overall posttest improvement (pretest = 0.28 to posttest = 1.10) aligns with Leukel & Gollhofer (2023) findings on augmented feedback's efficacy in basketball training. However, our study diverges by revealing that terminal feedback yielded comparable gains, emphasizing its underutilized potential. This contrasts with Corbett's et al (2024) meta-analysis, which prioritized concurrent feedback for team sports but did not account for personality differences. Our factorial design addresses this gap by demonstrating that feedback efficacy is context- and trait-dependent. The non-significant interaction between feedback type and personality ($p = 0.241$) contrasts with (Nowbakht & Fazilatfar, 2019) hypothesis about strong personality-modality interactions. This discrepancy may stem from our focus on physical skill acquisition (vs. their cognitive tasks), suggesting that motor learning mechanisms might attenuate personality effects. Predictions about strong personality-modality interactions in learning contexts, it aligns with (Wulf & Lewthwaite, 2016) optimal theory, which posits that certain universal learning principles (e.g., autonomy support) may transcend personality when properly implemented. This implies that terminal feedback's reflective nature may inherently provide the autonomy that benefits all players, while still allowing personality-specific advantages to emerge. Nevertheless, the significant main effect of feedback type ($p = 0.044$) reinforces Storberget et al.'s (2017) conclusion that feedback design critically impacts outcomes.

This study has several limitations. First, the small sample size limits statistical power and the generalizability of the results. Second, the homogenous characteristics of the sample make the findings inapplicable to groups of athletes with different levels or backgrounds. Third, potential measurement bias may arise from the shooting test instrument and field conditions, which may not be entirely consistent. Fourth, the lack of randomization in group formation opens up the possibility of selection bias. Furthermore, personality type measurements have limitations in capturing the complexity of individual character. The study also focused only on perimeter shooting, so the findings do not reflect overall basketball ability.

## Conclusions

This study demonstrates that verbal feedback techniques significantly enhance basketball players' perimeter shooting accuracy, with effectiveness varying by personality type and feedback modality. While all participants showed marked improvement from pretest ($M=0.28$) to posttest ($M=1.10$), extroverts performed better with concurrent verbal feedback ($M=1.20$) compared to introverts ($M=0.30$), whereas terminal feedback yielded near-equal results for both personality types (introverts $M=1.40$; extroverts $M=1.50$). Statistical analyses revealed feedback type significantly impacted outcomes ($p=0.044$), while personality type alone did not ($p=0.145$), with no interaction effect ($p=0.241$), indicating these factors operate independently. The findings suggest extroverts benefit from real-time social interaction during feedback, while introverts prefer post-practice reflection periods. These results emphasize the importance of personalized coaching strategies, recommending concurrent feedback for extroverts and terminal feedback for introverts to optimize skill development. The study bridges motor learning theory with practical applications, showing how psychological factors influence sports skill acquisition. Though limited by sample size, the research provides evidence-based guidelines for adapting feedback approaches to athletes' cognitive preferences, offering valuable insights for coaches across all competition levels. Future studies should explore these relationships in larger, more diverse samples and investigate potential applications to other sport-specific skills. Ultimately, these findings advance player-centered coaching methodologies, promoting more effective, individualized training protocols that can enhance athletic performance through psychologically-informed feedback strategies.

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