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Short-Term Effect of Attributional Versus Non-Attributional Negative Normative Feedback on Motor Tasks: A Double-Blind Study

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Featured Application: This study's results can be applied in sports coaching and rehabilitation by using attributional negative feedback to enhance motor performance and improve skill retention, providing a more effective approach for teaching and training motor tasks.

Abstract: Augmented feedback can alter motor performance. We examined if presenting attributional versus non-attributional negative normative feedback differently impacted short-term motor performance. With a double-blind experimental design, 49 students (36.7% female, Mage = 17.14 and SD = ±0.35) were assigned to the following two groups: G1: Attributional Negative Normative Feedback group (n = 24) and G2: Non-Attributional Negative Normative Feedback group (n = 25), with the dependent variable being the score obtained on a dart-throwing test. The results showed that those participants who received negative social comparative feedback presented in an attributional way (internal, controllable, and unstable) obtained higher scores in the dart throwing task than those who received negative social comparative feedback presented in a non-attributional way. Furthermore, these differences were maintained in the retention and transfer tests conducted 24 h after the practice phase. These findings have practical implications in motor behavior learning and performance.

Keywords: augmented feedback; motor performance; motor learning; knowledge of results

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1. Introduction

Augmented feedback (AF) is defined as externally sourced feedback provided either as knowledge of results or knowledge of performance [1]. AF has been shown to influence motor performance, either enhancing it [2] or impairing it [3]. This effect can occur over both long-term [4] and short-term periods [5].

The impact of AF has been demonstrated in various interventions where it serves as a dependent variable to enhance motor performance [2,6,7]. Moreover, these effects have been observed when feedback is delivered through social comparison or normative feedback [8,9]. Normative feedback (NF), by definition, involves social comparison. Specifically, performance improvements have been found when participants are informed that they are performing better than their peers (positive NF) compared to when they are told they are performing worse (negative NF) [9–12]. This performance enhancement of the positive NF group over the negative NF group in a motor task is evident in both the acquisition and retention phases after a 24–48 h rest period [2,3,13–16].

A key factor in the effect of AF on motor behavior is perceived personal control. Perceived personal control refers to the belief that outcomes are determined by one's own behavior rather than external factors or chance. Perceived personal control plays a crucial role in forming the expectation of achieving instrumental outcomes [17,18]. Furthermore, greater perceived control over one's environment is inherently rewarding [19] and can influence performance expectations [7].

Perceptions of control can be manipulated through the delivery of successful outcomes [19] or by inducing an illusion of control through AF [3]. In both cases, the feeling of personal control may be overestimated or underestimated compared to the actual contingencies between actions and outcomes [20]. Arguably, outcomes depend more on perceived control than on objective control, and thus, manipulating perceived personal control during an activity may improve performance [21]. According to Turk [22], accompanying tasks with feedback—both physical and verbal—should be considered to achieve a change in the behavior of individuals. Thus, if subjects, when attributing the cause of certain results, think that they can do nothing to control their success, their efforts on the task will be minimal, leading to frustration.

Research on attributional style is extensive across various domains of human functioning. However, relatively little research has been conducted to explore whether the induction of attributions about motor skills, whether learned or innate skills, can affect motor learning and performance. Jourden et al. [17] provided some intriguing findings regarding how perceptions of a particular task influence its execution. Young adults who believed they were engaging in a pursuit-rotor tracking exercise to develop an acquirable skill demonstrated better performances. They also reported greater confidence in their abilities and a higher interest in the activity. In contrast, participants who were led to believe that the exercise was a measure of an innate and immutable capacity showed no improvement. Furthermore, their feelings of confidence in their ability and interest in the exercise were decidedly lower. These findings suggest that how an activity is presented significantly influences both its perception and actual performance.

A follow-up study further supported these results by examining participants' learning a balance task [23]. Long-term retention tests revealed a stronger overriding effect when instructions at the outset of learning emphasized that the skill could be developed through practice. Conversely, learning was less effective when the task was framed as a reflection of innate ability or when instructions did not address this issue at all. These findings underscore the critical importance of how instructions are framed, as they not only affect immediate performance but also long-term retention, and hence the shaping of the overall learning process depends crucially on them too.

Research on the interaction between feedback and ability beliefs has demonstrated their combined influence on learning a balancing task [24]. Participants were presented with contrasting framings of the task: for some, this was believed to be a skill that develops through practice, while others were told they performed the task as a reflection of an inherent, innate ability. This was quite a nice way of examining how these different kinds of mindsets shape the learning process. The manipulation of the initial framing was aimed at finding subtle ways in which our beliefs about our abilities can influence how we approach and master new challenges. These instructions made up the foundation for four groups: (1) Inherent-Ability Better, where participants were informed that performance reflected an inherent ability and they were doing well; (2) Inherent-Ability Worse, where participants were told the task reflected an inherent ability but they were performing poorly; (3) Acquirable-Skill Better, where participants were informed the task reflected a learnable skill with practice and they were performing well; and (4) Acquirable-Skill Worse, where participants were told the task was a learnable skill but their performance was poor. Participants in the Acquirable-Skill groups ended up with the best performance. And this shows that when we tell people that they can improve with effort, rather than saying some folks are just naturally good at something, they tend to do better.

These results were also observed in 10-year-olds practicing football kicks aimed at a target. While performing the task, some participants received generic positive (person-related) feedback that sought to induce beliefs in inherent skill, while others received non-generic (process-related) feedback that sought to induce a learnable view of the skill. Those who received process-related feedback outperformed those who received person-related feedback and these results persisted after 24 h [6]. These data are consistent with previous research showing that children who received generic positive feedback while drawing were more vulnerable than those who received non-generic positive feedback and dropped out of the activity more quickly while self-rating their skills more poorly [25].

As previously mentioned, motor learning studies often report superior outcomes on learning when participants receive positive AF [7], particularly in tasks requiring accuracy [26]. However, the opposite results have also been observed. In this regard, Halperin et al. [27] investigated how positive, negative, and no AF conditions influence elbow flexor force production and EMG activity in 22 resistance-trained participants. The main findings were that participants applied greater force and demonstrated greater EMG activity in the negative AF (nAF) condition than the other two conditions [27].

These seemingly contradictory results may be partially explained by a limitation in the AF or NF literature (whether positive or negative): when outcome/result or performance feedback is given to participants, most studies have not discriminated between attributional and non-attributional feedback [7,12,27–30]. For instance, individuals who receive negative NF that was attributional (internal, controllable, and unstable) achieved higher motor task scores in the long term compared to those who receive non-attributional negative NF [30].

In this context, attributional style is categorized as either functional or dysfunctional [28]. Individuals who use internal, controllable, and unstable causes to explain personal failure tend to experience positive motivational consequences [31]. Therefore, this attributional style for explaining failure may be functional, as it increases persistence and improves task performance due to practice [32]. Conversely, individuals who make internal, uncontrollable, and stable attributions to explain personal failure, or attribute it to external, uncontrollable, and stable causes, often experience negative motivational outcomes. As a result, these attributional styles may be considered dysfunctional as they diminish behavioral persistence, potentially leading to disengagement from the activity [33].

Building on previous research, the present study aims to expand the available knowledge on the role of negative NF, whether delivered in an attributional or non-attributional manner, on short-term performance in a closed motor skill task. We hypothesize that participants receiving negative attributional feedback (internal, controllable, and unstable) will outperform those receiving non-attributional feedback in a dart-throwing task (first hypothesis). Additionally, those participants who receive negative attributional feedback (internal, controllable, and unstable) will maintain higher performance levels 24 h after practice compared to those receiving negative non-attributional feedback (second hypothesis).

2. Materials and Methods

2.1. Design

This study employed a double-blind experimental design with two groups: G1—Attributional Negative NF group (internal, controllable, and unstable) and G2—Non-Attributional Negative NF group. The task was conducted over two sessions, spaced 24 h apart, and consisted of six phases of dart-throwing. Session 1 consisted of Phases 1 to 4 and Session 2 consisted of Phases 5 and 6 (45 throws × 6 phases). The dependent variable was the total score obtained in each dart-throwing phase. The independent variable was the type of negative, social NF (G1: Attributional [internal, controllable, and unstable] and G2: Non-Attributional). To control for potential confounding variables in the administration of feedback, each experimental group acted as its own control. In this way, any variation in the results would be due to the intervention effect itself. This design proposal has already been employed in other studies investigating the effects of feedback [8,9].

2.2. Participants

The initial sample included 52 volunteer high school students randomly assigned to one of the two experimental groups. A total of 49 participants completed the study (36.7% female). The mean age of the final sample was 17.14 years (minimum = 17 and maximum = 18), with an SD of ±0.35. Participants were divided into G1: Attributional Negative NF group (n = 24) and G2: Non-Attributional Negative NF group (n = 25).

The inclusion criteria were as follows: criterion 1: being 17 years or older; criterion 2: parental consent was required for participation; criterion 3: scoring from 1 to 9 on a 0–10 point scale of darts-playing experience--as part of this criterion, no participants were federated athletes or had experience with dart throwing (competitive) sport; criterion 4: completion of pre-evaluation tests; criterion 5: completion the two phases of dart-throwing; and criterion 6: not presenting any illness or taking any medication that could have prevented or interfered with participation.

Ethical approval for this study was granted by the Andalusian Ethics Committee of Biomedical Research Ethics Committee of Biomedical Research (Evaluation Committee of Huelva. Internal Code: 2214-N-20. Date of approval: 4 May 2021; Act: 05/21). The procedures used in this study adhered to the tenets of the Declaration of Helsinki of 1975, revised in 2013.

2.3. Instruments and Variables

Sociodemographic information and dart-throwing experience. During the screening phase, an ad hoc interview was conducted to collect basic sociodemographic information including year of birth, gender, the existence of diseases and medications that could interfere with participation, and dart-throwing experience of the participants. It was not a standardized interview, but one developed specifically for gathering the relevant information needed for this particular research. To evaluate the level of experience in dart-throwing, participants were asked to answer two questions: (1) to indicate their experience in dart-throwing on a scale from 0 (I have never played darts) to 10 (I have a lot of experience, I even compete, equivalent to several years of regular practice), and (2) they were asked: 'Approximately how many times do you estimate that you have played darts in the last two years? (Less than 5 times, between 6 and 15 times, between 16 and 25 times, more than 25 times)'.

Self-Efficacy. This was measured using the General Self-Efficacy Scale (GSES) [34,35], which was also administered during the screening phase. This scale assesses the stable feeling of personal competence to handle stressful situations. Higher scores reflect greater perceived self-efficacy. The scale consists of 10 items (e.g., item 2.—"I can solve difficult problems if I try hard enough") with 4-point Likert-type response scales. (1.—"Not at all true", 2.—"Barely true", 3.—"Moderately true" and 4.—"Exactly true"). In the present study, the scale yielded a Cronbach's alpha coefficient of 0.74. This allowed for controlling for the possible influence of self-efficacy on subsequent performance, as self-efficacy resulting from experiences during the practice of a motor task is found to predict performance in subsequent motor learning tests [14,16] or performance [36,37].

State anxiety. We used the State Anxiety subscale of the State-Trait Anxiety Inventory (STAI) [38], and it was measured before proceeding with the dart-throwing. This subscale consists of 20 items (e.g., item 1.—"I feel calm") with 4-point Likert-type response scales (0.—"Not at all", 1.—"Somewhat", 2.—"Quite a lot" and 3.—"Very much"). In this study, this scale yielded a Cronbach's alpha of 0.86. Anxiety has been found to exert a relevant influence on both motor learning and motor performance [39].

Dart preference and forced allocation. Before the start of throwing, to control for the influence that forced allocation or lack of choice and dart preference may have on the performance and outcomes of a motor task [40,41], participants were asked to rank five darts based on their preference for the color and pattern of the dart feather. The scale ranged from 0 (least liked) to 4 (most liked). Then, before starting the throws, they were allowed to choose between the darts ranked 3–4.

Attentional focus and perceived pressure. The effect of attentional focus [2,42,43] was controlled at the end of Phases 2, 3, and 4 when participants were asked about where they had focused their attention during the throws, using the following question: "In this phase, during the dart throws, where did you focus your attention: (a) on the dartboard, where you wanted to aim the dart (External Focus); (b) on the arm–hand position, the sensations and movement of the body and arms (Internal Focus); and (c) mixed, alternating between both (Mixed Focus)". At the same time, and to assess whether the pressure to achieve the maximum number of points was influenced by the information received, they had to quantify this pressure on a scale that ranged from 0 ("I didn't notice any pressure") to 10 ("I noticed a lot of pressure"). Perceived pressure has been found to exert a relevant influence on motor performance [3].

2.4. Procedure

Sample Size Calculation. The required sample size for this study was estimated using G*Power software (version 3.1). A priori analysis was performed to determine the minimum number of participants needed in each group to achieve a statistical power of 0.95, with a significance level (α) of 0.05. The sample size calculation was based on a mixed ANOVA design with two groups and six measurement points. The results indicated that a total of 44 participants (22 by group) would be necessary to detect a medium-sized effect (f = 0.20) in the analysis. By the conclusion of the study, three participants had dropped out for various reasons, resulting in a final sample size of 49 participants (Figure 1).

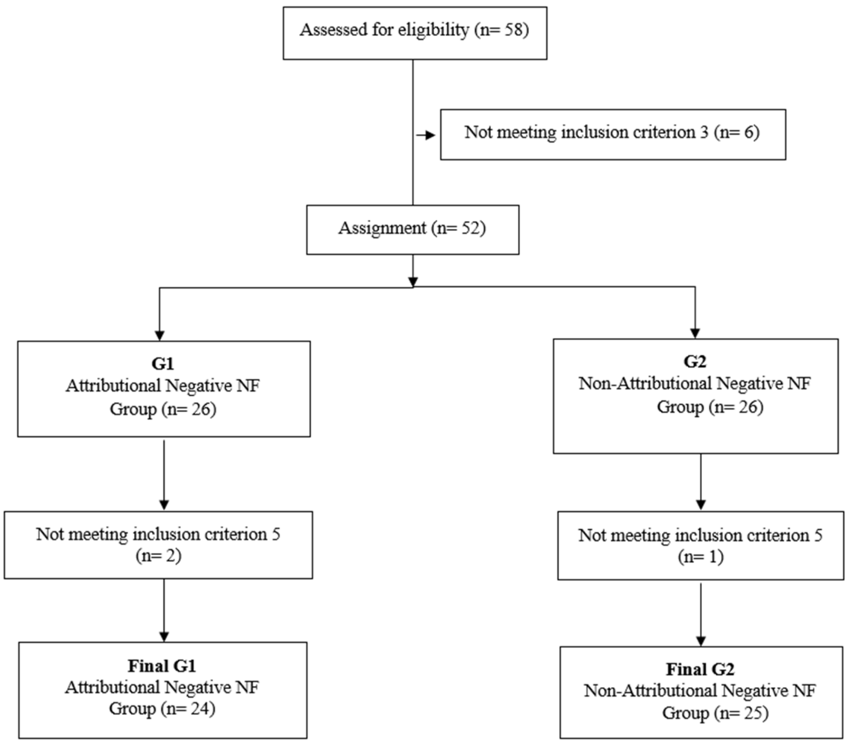

Figure 1. Diagram illustrating the process of recruitment, group allocation, and the final selection of study participants.

Recruitment phase. The participants were recruited by asking for volunteers in the classrooms of a secondary school. The study participants, as they were minors, were given an information sheet about the study in order for their parents or guardians to give their consent for participation. To be able to participate in the study, the participants had to meet the following requirements: a willingness to voluntarily participate in the study and submit the consent form signed by their parents or, failing that, by their legal guardian.

Those who agreed to participate in the study had to present parental authorization, after which they completed the ad hoc interview, the GSES, and the darts experience scale. Finally, they were asked to report the number of times they had played darts in the last two years.

Distribution of participants. This process was carried out based on the scores obtained on GSES. The highest GSES score was drawn among the participants and assigned to G1 and the next highest to G2 (see Figure 1). This process was repeated until all participants were distributed into the study groups and thus matched for self-efficacy.

Manipulation of expectations. The aim of the study was hidden from participants. To reduce the influence of demand characteristics during task performance [44], expectations about the actual aim of the study were manipulated during the volunteer recruitment phase and at the beginning of the throwing sessions. To conceal the real objective, participants were informed that the aim of the research was "to analyze the possible influence of the presence–absence of music and the compulsory nature of music during throws (with three groups: GA—with compulsory music; GB—without compulsory music and GC—with/without music by choice) on motor performance and dart-throwing scores". During the throws, in all cases, there was a music system present but not activated. All participants were told that they had been assigned to "GB: without compulsory music". To establish whether the actual goal had been successfully masked, after the completion of all throwing phases and at the end of participation, they were asked "what do you think was the goal of the activity you have just performed?".

Dart-throwing program. The participants were invited to a specific classroom provided by the school after the recruitment and assignment phase. At the beginning of the first session, they were informed of the "simulated target" of the research and the "supposed group" in which they were included. After being informed, they completed the STAI before the dart-throwing phases. Then, the darts were thrown with the dominant hand. In all cases, it was the right hand, at 2.37 m from the front of the target, which was located 1.74 m from its center to the ground. The target was 42 cm in diameter with concentric circles listed from 1 to 9, with a central point of a value of 10.

Before starting the dart-throwing phase, participants were asked to rank five darts based on color preference and feather pattern. To establish the baseline, the dart placed in position 2 of the ranking was taken. After completing a warm-up phase (3 sets × 3 throws), the first four phases were carried out during the first session. Each throwing phase consisted of fifteen heats with three throws each (45 throws × 4 phases). At the end of Phase 1, which acted as a baseline, feedback was given according to the group to which the participants belonged (G1.—Not very good, "it seems that you have not tried hard enough and have not exceeded the average of the group of participants"; "it seems that with your effort you have not obtained results comparable to those of your group"; or "it seems that you are not focused and this has led you to obtain results below those of the previous participants in the group"; G2.—Not very good, "the results are not better than the average of your group of participants"; " the results are lower than expected considering your group"; or "the results are not better than those of the other participants").

Then, for the rest of the phases, the participants had to choose a dart from those that had been ranked in positions 3–4. Thus, choice and preference were controlled by constancy. During Phase 2 and Phase 3, feedback was given depending on the assigned group, after the seventh and fifteenth series. In Phase 4, feedback was given at the end of the fifteenth run. Once Phases 2, 3, and 4 were completed, attentional focus and perceived pressure were evaluated at three time points.

After 24 h, the second session began, in which they were asked to complete Phase 5 and 6 (45 throws × 2 phases), in which no feedback was given. Subsequently, to establish whether the study's real objective had been achieved, the participants were asked: "What do you think was the objective of the study?", which signaled the end of their participation.

The individuals responsible for data collection provided the feedback and developed the whole relationship with the participants, ignoring the purpose of the research. These collaborators were psychology students who, before starting the study, were told that they had to give negative AF, but they were not informed of its attributional character and were blinded to each study group. Each of them was given a script with the feedback to give. In addition, to increase the credibility of the feedback, collaborators were instructed to pretend to review the scores before giving feedback. Furthermore, they were instructed in the work they were going to do (e.g., reception of participants, "simulated" objective of the study, collection and recording of scores, etc.).

2.5. Data Analysis

First, control analyses were conducted to check that assignment had succeeded in equalizing the two groups before starting. For this purpose, Student's t tests were carried out on the variables of age, darts experience, perceived self-efficacy, pre-execution state anxiety, and perceived pressure. Chi-square tests were used to control for the distribution of the sex and attentional focus variables. A mixed analysis of variance (ANOVA) was carried out, considering the main effect and the interaction of the within-subject variable (Phases 1, 2, 3, 4, 5, and 6) and the between-subjects variable (G1—Attributional Negative NF group and G2—Non-Attributional Negative NF group). Effect sizes were reported in terms of partial eta squared ($\eta^2 p$). In addition, post hoc comparisons using Bonferroni's correction evaluated differences among G1 and G2. Previously, the two statistical assumptions of normality, homoscedasticity, and sphericity were checked, and in the case of non-sphericity, the Huynh-Feldt correction was applied. For homoscedasticity, a correction was used when the assumption was violated. The analyses were performed using Jeffreys Awesome Statistics Package (JASP, Version 0.14.1, Amsterdam, The Netherlands) and SPSS (IBM version 20.0, SPSS Inc., Chicago, IL, USA), with a level of significance of $p < 0.05$ for both.

3. Results

It was found that the study groups did not differ in terms of age, darts experience, perceived self-efficacy, or in any of the variables that were controlled in the procedure that could interfere with performance (Table 1). Thus, no differences were found for state anxiety, perceived pressure, or attentional focus. Furthermore, the sphericity condition (Mauchly's W) was met ($p = 0.082$). In addition, Levene's test indicated equality in variances between the two groups for all phases studied (Ph1: $F_{(1,47)} = 0.119$, $p = 0.730$; Ph2: $F_{(1,47)} = 2.557$, $p = 0.116$; Ph3: $F_{(1,47)} = 0.038$, $p = 0.846$; Ph4: $F_{(1,47)} = 0.589$, $p = 0.447$; Ph5: $F_{(1,47)} = 0.019$, $p = 0.891$; Ph6: $F_{(1,47)} = 0.372$, $p = 0.545$).

Table 1. Socio-demographic variables and variables controlled for in the procedure (self-efficacy, dart experience, state anxiety, perceived pressure, and attentional focus) for each group.

	G1	G2	Total		*p*
Women	9 (37.5)	9 (36.0)	18 (36.7)	$\chi^2_{(1,49)} = 0.012$	0.913
Age	17.21 (0.42)	17.08 (0.28)	17.14 (0.35)	$t_{(47)} = 1.268$	0.212
Self-efficacy	31.67 (3.92)	31.12 (4.00)	31.39 (3.93)	$t_{(47)} = 0.483$	0.632
Recent Practice				$\chi^2_{(3,49)} = 2.609$	0.456
≤5	13 (54.2)	15 (60.0)	28 (27.1)		
6 to 15	6 (25.0)	8 (32.0)	14 (28.6)		
16 to 25	2 (8.3)	0 (0.0)	2 (4.1)		
>25	3 (12.5)	2 (8.0)	5 (10.2)		
Exp. Darts	3.67 (1.99)	3.20 (1.78)	3.43 (1.88)	$t_{(47)} = 0.865$	0.391
State anxiety	14.25 (7.66)	17.64 (7.41)	15.98 (7.65)	$t_{(47)} = 1.574$	0.122
Pressure					
Ph2	5.63 (1.91)	5.60 (2.52)	5.61 (2.22)	$t_{(47)} = 0.039$	0.969
Ph3	6.13 (2.36)	6.04 (2.78)	6.08 (2.56)	$t_{(47)} = 0.115$	0.909
Ph4	6.29 (2.42)	6.04 (2.99)	6.16 (2.70)	$t_{(47)} = 0.323$	0.748

Table 1. *Cont.*

	G1	G2	Total		p
Ph2-A.F.				$\chi^2_{(2,49)} = 1.653$	0.438
External A.F.	13 (54.2)	16 (64.0)	29 (59.2)		
Internal A.F.	5 (20.8)	2 (8.0)	7 (14.3)		
Mixed A.F.	6 (25.0)	7 (28.0)	13 (26.5)		
Ph3-A.F.				$\chi^2_{(2,49)} = 3.991$	0.136
External A.F.	13 (54.2)	9 (36.0)	22 (44.9)		
Internal A.F.	6 (25.0)	4 (16.0)	10 (20.4)		
Mixed A.F.	5 (20.8)	12 (48.0)	17 (34.7)		
Ph4-A.F.				$\chi^2_{(2,49)} = 1.780$	0.411
External A.F.	10 (41.7)	10 (40.0)	20 (40.8)		
Internal A.F.	6 (25.0)	3 (12.0)	9 (18.4)		
Mixed A.F.	8 (33.3)	12 (48.0)	20 (40.8)		

Notes: Number and percentage of cases for categorical variables. Mean and standard deviation for continuous variables. G1: Attributional Negative NF group; G2: Non-Attributional Negative NF group; Ph: phase; pressure: perceived pressure to score; Exp. Darts: self-rating in darts experience; Recent Practice: recent practice in darts throwing in the last two years; A.F.: attentional focus.

It should be noted that, in response to the control question regarding the perceived aim of the study (to check whether the real aim had successfully been masked to avoid demand characteristics), only 12.2% of the participants believed that the study aimed to analyze the influence of feedback on the execution of dart-throwing (13.7% of G1 and 8% of G2).

3.1. Between-Group Differences

A mixed ANOVA was conducted to test the influence of the manipulation of attribution in negative NF. The results revealed that there was no significant interaction between the study group and the phase variables ($F_{(5,469.143)} = 1.736$, $p = 0.127$). The means and standard deviations of the dependent variable (total score in each phase) for the two groups are shown in Table 2. Inspection of Table 2 indicates that the scores of the G1 group were higher than those of G2. Given that the repeated effect of time on performance did not interact with the study condition, the main effects for each factor were analyzed. Main effect tests revealed differences between groups in phases 3, 4, 5, and 6 (see Table 2). Contrarily, the effect of repeated measures was not significant (G1: $F_{(5,1587.944)} = 3.890$, $p = 0.003$; G2: $F_{(5,1262.215)} = 2.392$, $p = 0.042$).

Table 2. Means (M) and standard deviations (SD) for dependent variable (throwing score), and analysis of variance to study the main effects of the variable study group (manipulation of attribution) in each phase.

	G1	G2	Total	$F_{(1,47)}$	p	$\eta^2 p$
Session 1						
Phase 1	252.79 (38.90)	235.92 (36.33)	244.18 (38.18)	2.464	0.123	0.050
Phase 2	261.38 (21.73)	246.16 (35.51)	253.61 (30.26)	3.240	0.078	0.064
Phase 3	270.88 (37.86)	237.88 (40.72)	254.04 (42.35)	8.610	0.005	0.155
Phase 4	276.33 (40.99)	247.84 (35.89)	261.80 (40.70)	6.715	0.013	0.125
Session 2						
Phase 5	262.63 (38.52)	229.68 (40.98)	245.82 (42.75)	8.393	0.006	0.152
Phase 6	265.33 (37.80)	233.84 (43.98)	249.27 (43.65)	7.199	0.010	0.133

Note: G1: Attributional Negative NF group; G2: Non-Attributional Negative NF group; $\eta^2 p$ = partial eta square.

3.2. Within-Group Differences

The repeated measures ANOVA revealed that there were differences in the scores obtained between the six phases for both groups (G1: $F_{(1,47)} = 3.890$, $p = 0.003$; MSE = 408.168; G2: $F_{(1,47)} = 2.392$, $p = 0.042$; MSE = 527.579) (see Figure 2). The effect sizes are larger for

G1 (η^2p = 0.15) than for G2 (η^2p = 0.09). Bonferroni post hoc tests showed that for G1 there were significant differences between phases first and four (p = 0.049). In G2, although the ANOVA showed differences, these were so small that the post hoc analyses between phases revealed no significant differences. Figure 2 shows the evolution of the scores in the two groups over the two sessions (six phases).

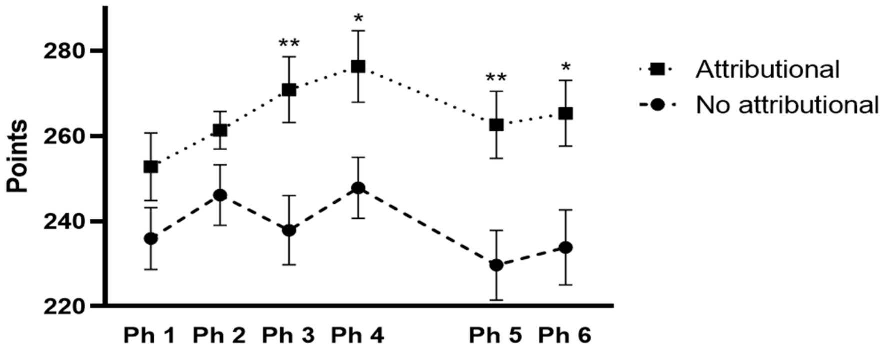

Figure 2. Evolution of the score in Session 1 [phases Ph1-Ph2-Ph3-Ph4] and Session 2 [Ph5-Ph6]. Note: Attributional—G1: Attributional Negative NF Group; No attributional—G2: Non-Attributional Negative NF Group; Ph: Phase; ** $p < 0.01$; * $p < 0.05$.

4. Discussion

The present study sought to investigate the role of negative NF, when delivered in an attributional or non-attributional manner, on short-term performance in a closed motor skill task. We hypothesized that those participants receiving negative NF in an attributional (internal, controllable, and unstable) manner would obtain higher scores on a dart-throwing task than those receiving non-attributional negative NF. As a second hypothesis, it was expected that those participants who received attributional negative NF, compared to those who receive non-attributional negative NF, would maintain higher scores in the retention and transfer tests carried out 24 h after the practice phase.

Regarding the first hypothesis, it was found that those who received negative social NF presented in an attributional way (internal, controllable, and unstable) obtained higher scores on the dart-throwing task than participants who received negative social NF presented in a non-attributional way. These data are congruent with the prediction made by Weiner [31]. Furthermore, this author established that individuals who use internal, controllable, and unstable causes to explain personal failure tend to experience positive motivational consequences, which results in a functional attributional style as it increases persistence and improves task performance due to practice [32].

Similarly, our results are in line with the improvements observed in the study by Halperin et al. [27], who delivered positive AF (pAF), nAF, and a no-AF condition and found that participants applied greater forces and showed greater EMG activity in the nAF condition than the other two conditions. Halperin et al. [27] explain these results by appealing to the notion that nAF may have triggered an emotion of anger, which has been shown to positively influence performance with tasks requiring force and power production [45,46], or that nAF may trigger negative feelings, indicating that the rate of progress towards a goal is too low and that more effort needs to be made [47,48]. In this sense, it is feasible to interpret our findings as indicating that nAF may have a positive influence on precision tasks, in addition to tasks where force and power production are required.

In a similar vein, it has been reported that, in some circumstances, nAF can have practical benefits over non-feedback [27]. However, it has been noted that nAF should be administered with caution, as it may also hinder motivation and self-efficacy over time, as shown by García et al. [20], who found that a group receiving negative feedback showed significantly lower levels of subjective vitality following a handball throwing task.

These contradictory results could be explained by the fact that the authors did not differentiate between attributional (pAF: [1] "Great effort" [3] "You look strong"; nAF: [1] "You are not trying hard" [3] "You can do better") and non-attributional (pAF: [2] "Excellent values"; nAF: [2] "Low values") feedback. When explaining this lack of support in certain nAF conditions compared with the no-AF condition, it should also be noted that participants given nAF on knowledge of result at low frequencies may not show improvement during practice and in the 24 h retention phase [9].

Thus, in the present study, it is possible that the greater improvement in performance shown by the dart throwers given attributional negative feedback (internal, controllable, unstable) can be seen as an indication that the participants were not making sufficient effort to improve the execution of a skill that depends on them. In contrast, in the group given non-attributional negative feedback, who, despite having tried to improve during the various phases still did not show positive results from the feedback given to them, this might have generated feelings of incompetence in the skill. Furthermore, this explanation is also supported in a study that examined the effect of attributional feedback after perceived failure on behavioral expectancies and persistence, in terms of immediate, long-term (durability), and transient effects (generalization). Rascle et al. [30] observed that functional (controllable and unstable) attributional feedback led to more personally controllable attributions after failure in a golf task, along with an increase in success expectancies and persistence. In contrast, dysfunctional attributional feedback (uncontrollable and stable) led to more uncontrollable and stable attributions following failure, along with lower success expectancies and lower persistence.

Regarding our second hypothesis, we expected to find that those who received attributional negative feedback, compared to those who received non-attributional negative feedback, would maintain higher scores on the retention and transfer tests 24 h after the practice phase. The results confirmed that those who received attributional negative feedback maintained higher scores on the retention and transfer tests 24 h after the practice phase than the non-attributional feedback group. These results also support those of the study by Rascle et al. [30] regarding the effect of attributional feedback after perceived failure on expectations and behavioral persistence, both concerning durability and generalizability, where it was observed that the effects extended beyond the intervention period, being present up to four weeks after the intervention and maintained even when participants perform a different task. It can thus be concluded that the effects of attributional feedback are durable over time and generalize across situations. In general, participants who adopt a functional attribution style tend to persist and increase their efforts when faced with errors during practice. In contrast, those with a dysfunctional attribution style in the same scenario do not persist and respond with helpless behavior [6]. In addition to the effects of the attributional nature of feedback on execution, performance, and its transfer to retention tests, the effect of the frequency with which knowledge of result feedback is given [9] and the generation of expectations of uncontrollability in situations of failure related to learned helplessness [49] must be considered.

It should be noted that the measures taken to control for variables that might affect performance in the dart-throwing task were effective. The groups were found to be equivalent in self-efficacy, pre-throwing state anxiety, and perceived pressure after the dart throws. Furthermore, all participants were offered a choice of dart feather color and pattern to control for the possible influence of forced assignment and preference, both of which can affect the performance and outcomes of a motor task [40,41]. Similarly, it has been found that only 12% of the participants believed that the study aimed to analyze the influence of feedback on the execution of dart-throwing, which suggests that the impact of demand characteristics was likely to be minimal [44]. Similarly, the groups did not differ in terms of attentional focus, thus minimizing the influence of the interaction between attentional focus and feedback on task performance [2,24,42].

The practical implications of these findings are significant for sports psychology and coaching. Coaches and practitioners can apply techniques that focus on managing expectations and enhancing self-efficacy to improve athlete performance, especially in precision tasks like dart-throwing. Incorporating attributional feedback could lead to better motivation and persistence in athletes, ultimately boosting their overall performance. Furthermore, psychological interventions aimed at improving self-efficacy may reduce anxiety and enhance task execution, providing valuable strategies for training programs.

This study has several limitations. First, prior research has highlight the importance of controlling for the frequency of feedback delivery [9], as this factor can significantly influence the efficiency of task performance. In the present study, the feedback frequency was not systematically controlled, which may have affected the outcomes. Additionally, it is essential to understand the degree to which participants 'believe' or accept the content of the feedback they receive [44,50], as it can impact their performance and motivation. Our study did not measure the participants' perceived credibility of the feedback, which may have introduced variability in their responses.

Another limitation concerns the composition of the study groups. We focused only on two groups (attributional and non-attributional groups). Future research could benefit from including additional groups, such as one with a dysfunctional attributional style (external, uncontrollable, and stable) and another group that does not receive any feedback. This would provide a more comprehensive understanding of how different attributional styles and the absence of feedback affect task performance and motivation.

It is also important to note that the study sample was limited to a specific population group, which may restrict the generalizability of the findings. Future studies should consider including a more diverse sample, including athletes with different levels of experience, to assess whether the results generalize to populations with greater variability in precision task experience.

Furthermore, due to the cross-sectional design of the study, we were unable to assess changes over time or the long-term effects of the interventions. Longitudinal studies could help examine how expectation and self-efficacy-based interventions impact performance over time, providing a more complete understanding of their lasting effects.

Finally, we did not control for potential variations in the wording of feedback statements, which could have elicited different motivational responses [24,25]. Standardizing the language of feedback more rigorously in future studies would be essential to better isolate the specific effects of feedback type on performance and motivation.

In terms of future directions, expanding the study to explore how individual differences, such as personality traits or prior experience, interact with feedback type could provide deeper insights. Additionally, investigating the long-term effects of feedback on performance and motivation across different tasks or contexts would contribute to a more holistic understanding of the role of feedback in learning and performance improvement.

Further research could explore how cultural differences influence the perception and effectiveness of feedback, as well as how feedback affects more complex or team-based tasks. Investigating emotional factors like anxiety or self-confidence could provide insights into how these variables moderate the impact of feedback.

Additionally, studies should assess the role of feedback across different task types (cognitive, physical, creative) and include diverse samples to improve generalization. Finally, the use of new technologies, such as real-time biofeedback or AI systems, could offer innovative approaches to enhance learning and performance.

5. Conclusions

Overall, the results of the present study show that when negative comparative social feedback presented in an attributional (internal, controllable, and unstable) manner is provided, individuals obtain higher scores on the dart-throwing task, demonstrating enhanced performance, compared to those who receive negative comparative social feedback presented in a non-attributional manner. Moreover, scores were also higher even 24 h after the practice phase, supporting a retention and transfer effect (at least for a short time). These results seem to indicate that, in practical terms, in the learning of a closed discrete task--such as dart throwing--providing negative comparative social feedback presented in an attributional way, and with possibilities of control over the execution (i.e., "it seems that you have not tried hard enough and have not exceeded the average of the group of participants"), produces a greater impact on learning than providing non-attributional negative comparative social feedback (i.e., "the results are not better than those of the remaining participants"). These findings may inform the design of performance-enhancement training in the contexts of physical education or competitive sport for the improvement of motor learning and performance.

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