Differential Effects of Verbal Coaching Cues and Analogies on Sprint Performance in Youth Male Soccer Players Across Grass and Indoor Surfaces

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Abstract

There is a limited body of research concerning the impact of different attentional foci on the performance or retention of fundamental motor skills in young individuals. Additionally, the influence of verbal cues on sprint performance across various surfaces, such as grass and indoor basketball courts, remains understudied. Therefore, the primary objective of this study was to assess the effectiveness of Internal Cues (IC), External Cues (EC), and analogies with a directional component (ADC) on sprint performance among youth soccer players on different surfaces (grass vs. indoor basketball court). Seventy participants, aged 12.3±0.5 years, with a maturity offset of -0.9±0.5 years, were recruited for this investigation. Multiple 20-meter sprint tests were conducted on both grass and indoor basketball courts using different coaching cues: a control/neutral cue, an internal cue, an external cue, and analogies (away and toward). The analyses did not reveal significant differences ($p \geq 0.05$) between cue types for both sprinting on grass and indoor surfaces. However, in post-hoc analyses for indoor sprints, significant distinctions were noted between ECs and ICs, favoring ECs ($p < 0.01$), as well as between "away" ADC and IC, favoring the "away" ADC ($p < 0.01$). Similar significant differences were observed for grass sprints, with ECs and "away" ADCs showing superiority over ICs ($p < 0.01$).

In conclusion, the study did not find evidence supporting specific instructional types' positive impact on youth's sprint performance on both grass and indoor surfaces. Notwithstanding, ECs and ADCs seemed to be more effective coaching strategies for improving sprinting performance in youth soccer players. Additionally, motivating young soccer players to give their maximum effort seemed to be a beneficial cueing method for enhancing sprint ability on different surfaces.

Key words: Attentional, focus, infrastructure, sprint, young soccer.

1.Introduction

Coaching instructions play a crucial role in shaping the quality of subsequent motor skill execution (1). Immediate instructions can lead to performance improvements, and long-term learning benefits are also achievable (2,3,4). Notably, adopting an external focus of attention (such as directing attention to the environment or outcome) has been shown to enhance performance compared to an internal focus (which emphasizes body movements) (5). Wulf et al. (5) found that performance retention improved when performers received external focus instructions before executing a task. However, limited research has explored the impact of different attentional foci on basic motor skills, like running and sprinting, particularly in youth populations

For example, two systematic reviews (6,7) examined numerous studies in this field. However, among those conducted with children, the majority focused on sport-specific skills, rather than fundamental movement skills (FMS) typically taught in physical education, such as jumping. Additionally, no studies have explored how different attentional focuses affect running or sprinting performance, which are crucial FMS for children's development. Overall, research on this topic within youth populations remains limited.

In the realm of sports coaching, analogies serve as powerful tools to convey complex concepts in a relatable and memorable way. By representing movement and actions symbolically, analogies enhance athletes' understanding and facilitate skill acquisition (15). For instance, Fasold et al. (16) found that delivering coaching instructions in an analogical format improved handball skills in nine to ten-year-old youths. Analogies can be likened to storytelling, allowing children to contextualize their sporting experiences and gain a deeper comprehension (14,17,18). Combining external cues (ECs) with analogies further enhances performance by maintaining a distal focus. As coaches, we can harness the art of analogy to inspire, educate, and empower athletes on their developmental journey (1).

In the context of physical education, coaching analogies play a pivotal role in enhancing skill acquisition and understanding. While extensive research exists on the use of internal and external foci of attention, investigations specifically exploring directional components (such as 'towards' versus 'away') remain scarce (19). Surprisingly, no previous study has examined the combined effects of these attentional foci with analogies, particularly in youth populations. Analogies, when merged with external cues, have been suggested as an effective strategy for maintaining a distal focus, ultimately optimizing performance (1,4). As we delve into this uncharted territory, coaches and educators can harness the power of analogies to facilitate learning and skill development among children

The primary objective of this investigation was to assess the efficacy of internal cues (IC), external cues (EC), and analogies incorporating a directional component (ADC) on sprint performance in youth soccer players across different terrain conditions, specifically grass and indoor basketball court surfaces. Drawing from the existing body of literature (16, 5, 19), we formulated the following hypotheses: 1) that ECs, ICs, and ADCs would significantly enhance sprint performance compared to control conditions on both grass and indoor basketball surfaces; 2) that ECs would yield greater improvements in sprint performance than ICs; and 3) that ADCs would outperform both ECs and ICs in promoting sprint performance. Given the critical role of attentional focus in motor skill execution, understanding the differential impacts of these cues on performance can inform coaching practices and training programs. Previous studies have predominantly concentrated on sport-specific skills, leaving a gap in research concerning FMS like running and sprinting, particularly in youth populations. This study addresses this gap by exploring how various types of attentional focus influence sprinting—a key FMS essential for athletic development in children. By investigating these relationships, our research aims to contribute valuable insights to the field of sports science, particularly in optimizing training methodologies for young athletes. The findings could have significant implications for coaches and physical educators in designing effective training interventions that enhance athletic performance across diverse playing surfaces.

2. Materials and Methods

2.1. Experimental design

The study was conducted during the preseason period of 2022 (from September to November). Participating individuals underwent multiple sprint tests, performed on grass and indoor basketball court surfaces, preceded by providing a specific coaching instruction relevant to their performance. The study encompassed experiments that involved a cohort of youth soccer players, specifically 12-year-old academy soccer players in Tunisia. Detailed descriptive characteristics of the various groups can be found in Table 1.

Table 1. Anthropometrics of the study cohort.

	(n=70)
Age (years)	12.3±0.5
Height (cm)	158.3±8.6
Sitting height (cm)	76.6±3.0
Body mass (kg)	40.6±7.6
Maturity offset (years)	-0.9±0.5
Predicted APHV (years)	13.30±0.46

With limited understanding regarding the impact of verbal coaching cues on performance among

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youth compared to adults, this methodology was deemed justifiable as it aimed to expedite the comprehension of this subject matter. Each participant performed 10 jumps and 10 sprints, preceded by an instructional cue provided immediately before each action. For the sprints, 5 distinct cues were utilized. The phrase "sprint as fast as you can" served as the control cue against which the various ICs, ECs, and ADCs were contrasted. These control cues were devoid of an attentional component, meaning they did not direct participants' focus to a specific body part or outcome.

2.2. Participants

Seventy male youth soccer players from two distinct soccer teams were enlisted to partake in this research endeavor. All participants had undergone structured soccer training for a minimum of 4-5 years before their involvement in the study and were actively engaged in competitive soccer within an academy setting. The biological maturity status of the participants was assessed using the maturity offset method, employing the predictive model proposed by Moore et al. (23) (PHV = 27.999994 + [0.0036124 x age x height]). Before the initiation of the study, athletes were provided with a comprehensive document delineating the experimental procedures, accompanied by a request for parental consent. Following a detailed elucidation of the study's objectives, methodologies, associated risks, and potential benefits, parental consent and participant assent were obtained. The study was conducted by the most recent version of the Declaration of Helsinki and was fully sanctioned by the Local Ethics Committee of the Higher Institute of Sport and Physical Education at Ksar-Said, Manouba University, Tunis, Tunisia (LR23JS01) before its commencement. None of the participating players had a documented history of psychological, musculoskeletal, neurological, or orthopedic disorders within the six months leading up to the study initiation.

2.3. Procedures

2.3.1. Warm-up before sprint testing

Before the commencement of the tests, a standardized eight-minute warm-up session was conducted by established protocols (24,25). Before the actual performance, participants were allowed to familiarize themselves with the sprint test format (26).

2.3.2. Y-Shape agility test

Participants were instructed to adopt a standardized 2-point stance, with a hip-width distance between their feet, where one foot was positioned behind the starting line and the other foot was set back comfortably. They were further instructed to arrange their arms in opposition to their legs, as previously described (26). Additionally, they were guided to "load into their legs and shift forward, feeling tension and readiness to sprint forward with no delay" (26). A single demonstration of this stance was provided to all participants at the onset of the session (26). Verbal instructions were delivered from a seated position situated 4 feet to the left of the starting line, where participants were positioned (26). Before commencing the sprint test, each participant received an individual briefing that stated: "The remaining ten sprints will be completed at maximum effort, with a specific coaching cue provided before each sprint. Focus intently on this cue throughout the entire sprint" (26). The sprint test was initiated when the participant voluntarily began sprinting immediately after receiving one of the instructional cues. A minimum of 2 minutes of rest was allotted between each sprint. Timing gates (Brower Timing Systems, Salt Lake City, UT, USA; with an accuracy of 0.01 s) were positioned at the starting line (0.3 m in front of the participants) and 20 meters away from the starting line (27,28).

2.3.3. Coaching cues

To mitigate potential order effects resulting from factors such as fatigue or other variables that could influence participant performance, a Latin square design was employed. Participants were assigned a random order scheme from 1 to 10 using a random number generator tool (https://www.random.org/). This scheme dictated the sequence of instructional cues before jumping or sprinting activities, with each letter in the scheme representing a unique coaching cue. Each cue was presented twice within the experimental sequence, as participants completed both sprints and jumps twice for each cue.

2.4. Statistical Analysis

Data analysis was conducted using JASP software (version 10.2, University of Amsterdam). The normality of the data was checked with the Shapiro-Wilk test and a Two Way Repeated Measures ANOVA was used to detect statistically significant ($p < 0.05$) differences in the dependent variables. The Bonferroni test was used for pairwise comparisons. Effect sizes were reported with corresponding 95% confidence intervals (CI). The effect sizes were interpreted by the guidelines established by Hopkins et al. (29) for standardized mean differences, which categorize effect sizes as follows: trivial (<0.2), small (0.2-0.6), moderate (0.6-1.2), large (1.2-2.0), very large (2.0-4.0), and extremely large (>4.0). Subsequently, a repeated measures analysis was conducted to investigate potential differences among the ECs, ICs, and analogies incorporating ADCs used in this study.

3. Results

All participants exhibited complete adherence to their assigned treatments, achieving a 100% adherence rate. No statistically significant differences were noted between cues at baseline for any of the sprint testing metrics.

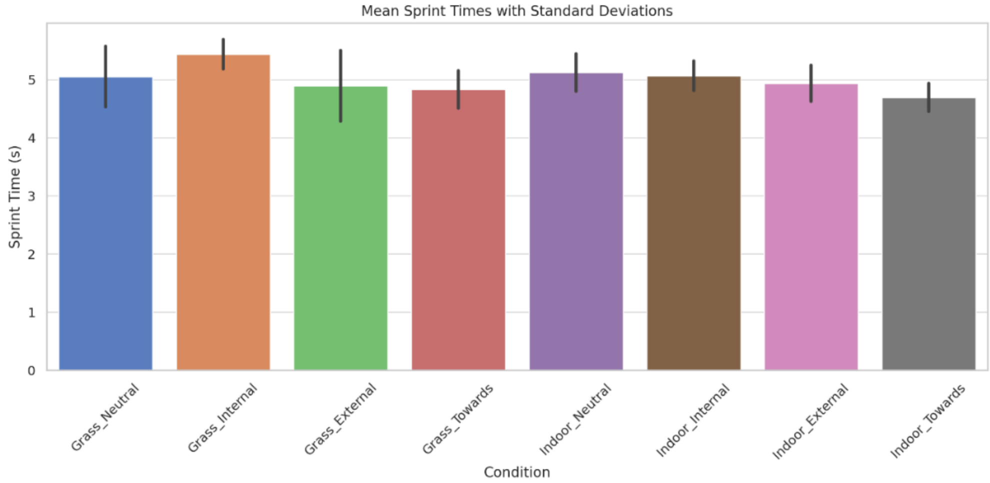

Figure 1. Bar Plot of Means with Standard Deviations

Figure 1 is a bar plot displaying the means and standard deviations for each condition. The repeated measures ANOVA revealed significant main effects and interactions on sprint times. Specifically, the effect of the surface was significant, $F(1, 69) = 11.890$, $p = 0.0009$, with a partial eta squared of 0.147, indicating that approximately 14.7% of the variance in sprint times can be attributed to the type of surface. The effect of the cue was also significant, $F(3, 207) = 54.358$, $p < 0.0001$, with a partial eta squared of 0.208, indicating that cues accounted for approximately 20.8% of the variance in sprint times.

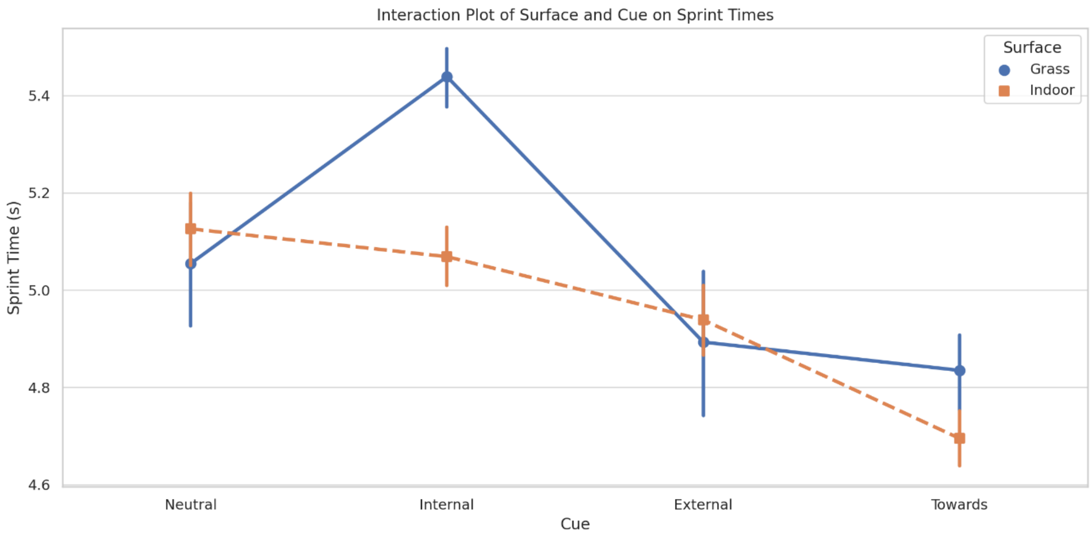

Figure 2. Interaction Plot of Surface and Cue on Sprint Times

Figure 2 is an interaction plot illustrating the relationship between surface type and cue on sprint times. There was a significant interaction effect between surface and cue, $F(3, 207) = 11.7763$,

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p < 0.0001, with a partial eta squared of 0.054, suggesting that the effect of cue on sprint times varied depending on the surface type.

Regarding the post-hoc analyses, for sprinting on grass, the comparison between internal and "Towards" conditions showed a large effect size (Cohen's d = 1.17, p < 0.002). The "Towards" versus "Away" comparison revealed a large negative effect size (Cohen's d = -1.30, p < 0.002). The comparison between "Away" and neutral conditions indicated a large effect size (Cohen's d = 1.40, p = 0.014). For sprinting on indoor surfaces, the internal versus external conditions demonstrated a large effect size (Cohen's d = 1.27, p < 0.001). The internal versus "Away" comparison indicated a large effect size (Cohen's d = 1.21, p < 0.001). Detailed post-hoc results are provided in Table 2.

Table 2. Post-hoc analyses of the effect of each cue type on sprint ability on grass versus indoor

		Mean ±SD	t	Cohen's d	Lower	Upper	p
Sprint on grass							
Internal vs.	External	4.89 ± 0.25	4.144	1.02	0.41	−0.37	0.862
	"Towards"	4.83 ± 0.32	1.612	1.17	0.57	−0.23	<0.002***
	"Away"	4.67 ± 0.25	4.232	−1.12	0.27	−0.52	0.138
	Neutral	5.05 ± 0.25	2.375	1.28	0.69	−0.14	0.105
External vs.	"Towards"	4.83 ± 0.32	−2.712	1.15	0.55	−0.25	>0.999
	"Away"	4.67 ± 0.25	−0.145	−1.15	0.25	−0.55	0.573
	Neutral	5.05 ± 0.25	−1.640	0.26	0.67	−0.16	0.183
"Towards" vs.	"Away"	4.67 ± 0.25	2.248	−1.30	0.12	−0.71	<0.002***
	Neutral	5.05 ± 0.25	0.543	0.11	0.50	−0.29	0.999
"Away" vs.	Neutral	5.05 ± 0.25	3.241	1.40	0.84	−0.04	0.014*
Sprint on indoor							
Internal vs.	External	4.80 ± 0.14	4.343	1.27	0.24	2.30	<0.001***
	"Towards"	4.93 ± 0.45	1.727	0.51	−! !! 0.37	1.38	0.882
	"Away"	4.69 ± 0.39	4.121	1.21	0.19	2.22	<0.001***
	Neutral	5.12 ± 0.16	2.492	0.73	−0.18	1.64	0.149
External vs.	"Towards"	4.93 ± 0.45	−2.615	−0.77	−1.68	0.15	0.107
	"Away"	4.69 ± 0.39	−0.222	−0.07	−0.91	0.78	>0.999

	Neutral	5.12 ± 0.16	−1.851	−0.54	−1.42	0.34	0.681
“Towards” vs.	“Away”	4.69 ± 0.39	2.393	0.70	−0.20	1.61	0.192
	Neutral	5.12 ± 0.16	0.765	0.22	−0.63	1.07	>0.999
“Away” vs.	Neutral	5.12 ± 0.16	-1.628	-0.48	-1.35	0.40	>0.999

Notes: SD, standard deviation. A positive effect size favours the cue listed second. ***p <0.001.

4. Discussion

The purpose of this investigation was to evaluate the effectiveness of ICs, ECs, and analogies incorporating ADCs on sprint performance in youth soccer players, with a particular focus on comparing performances on natural grass surfaces versus a basketball court. The results of this study suggest that manipulating directive language, as per the various coaching instructions examined, yields minimal benefits for performance. Contrary to our hypotheses, there was no evidence to support the notion that ECs, ICs, and ADCs would outperform control cues or that ECs would exhibit superior efficacy compared to ICs. Nevertheless, the findings suggest that ADCs may possess a greater efficacy than both ECs and ICs.

A coach's proficiency in effectively communicating instructions has been emphasized as a crucial factor in fostering motor skill development among young individuals (13). In this context, effective communication refers to the coach's ability to utilize terminology and verbal cues that are intelligible to the trainee (13), who is the intended recipient of these cues. As research suggests, understanding verbal cues is a fundamental requirement for youth engagement in physical activities (30). However, as youth undergo developmental changes, including variations in their neurocognitive capacities, abilities, and willingness to follow instructions, coaching challenges may differ significantly from those encountered when working with adults (30). The findings of the present study illustrate this dynamic, as demonstrated by the lack of significant differences in sprint performances observed across seven out of eight analyses comparing ECs, ICs, and ADCs with a neutral (i.e., control) cue in both grass and indoor basketball court conditions.

The Constrained Action Hypothesis (3) suggests that focusing externally can improve sprint ability by promoting automatic movement control and implicit learning (4). Conversely, internal focus may hinder automatic control and impair motor performance (5). Prioritizing the outcomes over the process of action might support self-organization, helping the motor system overcome conscious control constraints (5). While these ideas are well-established in adults (31), our research on motor skill execution in youth doesn't align with this hypothesis. Maxwell and Masters (32) proposed a practical explanation, noting that performers shifted from internal to external focus during a balance activity. Previous studies (33) comparing children and adults suggest shorter attention spans in children, linked to ongoing cognitive development and frontal lobe maturation (33). Thus, while theories like the Constrained Action Hypothesis are valuable for adults, younger individuals may benefit from a different approach.

In our study, young participants showed less responsiveness to coaching language, possibly due to their cognitive development stage.

Our study didn't show performance differences between ECs and ICs in young participants, hinting at a potential limitation in their frame of reference compared to adults. This limitation could be due to their limited life experiences, making them "naïve perceivers" (34). Young people might struggle to contextualize instructions as adults do, especially when analogies lack relevance to their experiences. Unlike adults who focus on relevant cues, children may attend to both relevant and irrelevant cues, impacting their response to coaching instructions (33). Hence, while adults might respond better to ADC instructions, younger individuals might not grasp them as effectively due to their limited contextual understanding.

This study presents several limitations worth noting. The utilization of the phrase "sprint as fast as you can" as control cues, although grounded in previous research (21, 22), resulted in experimental cues demonstrating no significant superiority over control cues overall. This lack of differentiation may be attributed to the absence of an established standard defining what constitutes a control cue, suggesting that these cues were equally effective in driving performance among the study participants. Consequently, exploring alternative cue compositions is warranted to ascertain the most efficacious forms of coaching language for enhancing performance in young individuals. Furthermore, the absence of female participants in the study significantly impacts the generalizability of the results, precluding the derivation of sex-specific conclusions at this juncture.

5. Conclusions

Our findings did not demonstrate any significant positive impact of instructional type on sprint performance, regardless of whether the activity occurred on grass or an indoor basketball court among youth soccer players. It is important to note that these results do not necessarily imply that targeted cueing and considering the playing surface (grass vs. indoor basketball court) cannot enhance performance in younger individuals; rather, they may suggest that additional performance improvements may only manifest once a young individual develops an implicit understanding of the coaching context. Future research in this field should take into account the limitations of our study, particularly by replicating similar experiments with female participants. This approach would contribute to a more comprehensive understanding of how instructional cues and environmental factors influence performance in youth athletes.

Availability of Data and Materials

Data are available for research purposes upon reasonable request to the corresponding author.

Author Contributions

AN RH, and HİC—designed the research study; RH, RO, HİC, VS and RIM wrote the manuscript. KÖ, TM, and MY— performed the research; HİC and RIM analyzed the data. All authors contributed to editorial changes in the manuscript. AN, RH, HİC, TM, KÖ, MY, RO, AM,RIM and VS critically revised the manuscript and approved the final manuscript for publication.

Ethics Approval
The study was reviewed and approved by the Local Ethics Committee of the Higher Institute of Sport and Physical Education of Ksar-Said, Manouba University, Tunis, Tunisia (LR23JS01). Written informed consent to participate in this study was provided by the participant's legal guardian/next of kin. Informed consent was obtained from all individual participants included in the study.

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Conflict of Interest
The authors declare no conflict of interest.

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