

---

# Physical Environment as a Determinant of Competency-Based Talent Identification Outcomes in Sprinting among Students: The case of the University of Bamenda

**Chia Helon Animbom (Ph.D.)**

The University of Bamenda, Cameroon

## Article information:

**Manuscript received:** 30 Dec 2025; **Accepted:** 30 Dec 2025; **Published:** 31 Dec 2025

**Abstract:** This study examined The University of Bamenda physical environment as a determinant of competency-based talent identification outcomes in sprinting among students. Elements of the physical environment considered included the surface of the running track, availability of sprint training equipment (blocks, cones, hurdles,), and adequacy of training space. A quasi-experimental research design was adopted. A sample of 40 University of Bamenda students was selected using a purposive sampling technique and divided into two groups based on their training environments: relatively adequate physical environment and less relatively adequate physical environment. A pre-test was conducted to establish baseline 100-metre sprint performance time and sprinting competencies (reaction time, acceleration, drive, and finish) before the intervention. The students then underwent an eight-week competency-based sprint training intervention focusing on reaction time, acceleration, drive, and finish phases of sprinting. Post-test measurements were taken at the end of the intervention period.

Findings revealed that students who trained in a relatively adequate physical environment demonstrated greater improvement in 100-metre sprint performance compared to those in a less relatively adequate environment. The average post-test 100-metre time for students in the less relatively adequate environment was  $16.2995 \pm 0.47157$  seconds, compared to  $14.9465 \pm 0.33620$  seconds for those in the relatively adequate environment. Similar trends were observed across all sprinting competencies. Students in relatively adequate environments recorded significantly shorter post-test times in reaction time ( $0.2405 \pm 0.00420$  s vs.  $0.2905 \pm 0.00958$  s), acceleration ( $4.8930 \pm 0.10828$  s vs.  $5.2360 \pm 0.13803$  s), drive ( $3.8565 \pm 0.13122$  s vs.  $4.6045 \pm 0.17881$  s), and finish ( $4.4965 \pm 0.12437$  s vs.  $4.3500 \pm 0.11891$  s) compared to their counterparts.

The study concludes that the quality of the physical training environment significantly influences competency-based talent identification outcomes in sprinting. Improved facilities, equipment, and training space enhance sprint performance and the development of key sprinting competencies among university students. The findings underscore the need for universities to prioritize adequate physical environments to support effective talent identification and athlete development in athletics.

**Keys words:** Physical Environment, Competency-Based Talent Identification Outcomes, Students, Sprinting.

---

## Introduction and Background

Talent identification in sprinting is a critical component of sport development, particularly within higher education institutions where a large pool of young adults with athletic potential exists. Universities play a dual role in providing academic training and nurturing sporting talent through structured Physical Education and sport programs. In recent years, the competency-based approach has gained prominence in Physical Education and sport training due to its emphasis on demonstrable skills, performance outcomes, individualized progression, and authentic assessment. The competency-based approach has become increasingly prominent in physical education and sport training as systems worldwide shift toward outcomes that emphasize what learners and athletes are able to do with their knowledge and skills in authentic contexts. This approach in Physical Education focuses on the development of clearly defined competencies such as motor skill proficiency, tactical awareness, decision-making, collaboration, and self-regulation rather than merely completing instructional content or accumulating training hours (Spencer & Spencer, 1993). In Physical Education, competency-based models support meaningful learning by aligning teaching, assessment, and progression with learners demonstrated abilities, promoting inclusivity and lifelong physical activity (Kirk, 2010). Similarly, in sport training, competency-based frameworks enable coaches to individualize development pathways and better prepare athletes for the complex demands of performance environments (Casey & MacPhail, 2018). Recent advances in sports pedagogy highlight the competency-based approach as an effective method for motor skill development and athletic performance enhancement. (Hellison, 2003).

Competency-based approaches in Physical Education prioritize observable and measurable performance skills over traditional normative benchmarks (Richards, 2017). Under this framework, learners progress based on demonstrated competencies such as start reaction time, acceleration, and technical execution, rather than time-based assessments alone (Gronlund & Hambleton, 2017). In sport contexts, competency-based approach enhances both instructional clarity and learner engagement, leading to more precise identification of athletic talent (Spencer & Maxwell, 2019). In sprinting, this approach has been shown to provide a structured format for evaluating athletes across multiple performance dimensions, allowing for a holistic assessment of potential beyond raw finish times (Anderson, 2020). As a result, competency-based approach supports talent identification by assessing component skills such as reaction time, acceleration mechanics, and sprinting technique each of which are critical indicators of sprint performance potential (Williams & Reilly, 2021).

In sprinting, competency-based talent identification focuses on measurable competencies such as acceleration, maximum speed, reaction time, running mechanics, and consistency of performance rather than reliance on subjective judgments or isolated performance trials. Talent identification in sprinting involves not only recognizing exceptional performance but also understanding the developmental pathways that lead to excellence (Vaeyens et al., 2008). Traditional models often rely heavily on performance results, which can disadvantage individuals whose foundational skills are still emerging (Baker et al., 2017). Contemporary research suggests that evaluating competencies in context provides a more accurate representation of an athlete's capabilities (Williams & Reilly, 2021). However, sprint performance is not strictly a function of individual ability; it is influenced by the interaction between the athlete and their training/testing environment (Araújo & Davids, 2018). This interaction is especially relevant in university settings, where training facilities and environmental conditions vary widely and can critically influence assessment outcomes (Henriksen, 2010).

The physical environment defined as the quality of facilities, training surfaces, equipment, and spatial resources affects both learning opportunities and skill expression in sport (Li et al., 2014). Sprint performance is sensitive to surface type (like tartan vs. grass), lane dimensions, and available space, all of which can influence reaction times, acceleration, drive and finish phases (McMahon & Greene, 2018). Martindale et al. (2005) argue that environmental conditions are key determinants of effective talent development outcomes. Chunxiao et al. (2014) explicitly opines that environmental factors influence expert performance and should be considered in talent identification and development contexts. Facilities that lack structured tracks or adequate space can inadvertently constrain athletes,

limiting their ability to demonstrate sprinting competencies fully (Bourbousson et al., 2019). According to Araújo & Davids (2011) as cited by Keith et al. (2021), studies within ecological dynamics posit that performance emerges from the interaction of organism and environment, where environmental constraints can either afford or restrict action capabilities. Araújo and Davids (2011) elucidate an ecological perspective which suggests that the term skill acquisition may not refer to an entity but rather to the emergence of an adaptive, functional relationship between an organism and its environment. Araújo and Davids (2018) argue for viewing athletes and their surroundings as inseparable units, challenging traditional internal (brain/body) focus by proposing the athlete-environment as the core for understanding expert action, emphasizing perception-action coupling and emergent behaviors shaped by constraints, not just mental skills. Consequently, physical environments that provide supportive affordances facilitate better expression of sprint skills and more accurate talent identification. Such environments will enhance competency-based training on sprinting competencies like reaction time, acceleration, drive and finish which can be brought together to enhance an overall good performance in sprinting events.

Empirical studies in Physical Education settings indicate that environmental constraints including inadequate training space, poor surface quality, and limited access to appropriate equipment can diminish the reliability of competency-based assessments (Li et al., 2014). For example, McMahan and Greene (2018) found that athletes tested on non-standard surfaces produced slower acceleration times compared to standard track conditions. Similarly, Williams and Reilly (2021) noted that inconsistent training environments impeded consistent performance improvements, thereby obscuring true talent potential. In a university context, environmental limitations such as multipurpose fields without marked sprint lanes or lack of timing systems can reduce assessment objectivity, undermining efforts to identify talented sprinters based on skill competencies (Henriksen, 2010). This supports the argument that physical environment must be considered alongside pedagogical approaches in talent development research. While environmental quality directly influences performance expression, institutional support determines whether environments meet the standards necessary for effective competency-based assessment (Martindale et al., 2005). Institutional factors such as policy prioritization of sport, resource allocation for facilities, and coaching expertise shape the quality of the sport environment available to students (Martindale & Collins, 2017). Institutions that provide quality facilities and structured training programs create enabling contexts where competency-based approaches can be implemented more effectively.

The physical environment of a university including the availability and quality of sprint tracks, training spaces, equipment, and safety conditions can significantly influence students' ability to demonstrate sprinting competencies accurately. Inadequate facilities, poor track surfaces, limited space, or lack of standard equipment may constrain performance expression and compromise the reliability of competency-based assessments. The University of Bamenda, like many public universities in developing contexts, operates within varying infrastructural and environmental conditions. While the institution has a growing interest in sports development, empirical evidence on how its physical environment influences the implementation of competency-based talent identification in sprinting remains limited. Specifically, empirical evidence from African universities remains limited, despite the diverse environmental conditions and resource levels across campuses. This study addresses this gap by examining how The University of Bamenda's physical environment influences competency-based sprint talent identification outcomes among students.

### **Statement of the Problem**

Despite the adoption of competency-based approaches in Physical Education and sport training, the identification of sprinting talent in many universities remains inconsistent and often ineffective. At the University of Bamenda, students participate in athletics activities, yet only a small proportion are accurately identified and developed as sprinting talents. As a result of this inaccuracy in identifying and developing sprinting talents, the university has witnessed poor performance in recent years in sprinting events, especially during university games. In 2024 for example, results from the athletics workshop

during the games reveal that no athlete from The University of Bamenda qualified for the finals in all sprinting events, talk less of winning a medal. In the 2025 edition of the games, the same poor performance was recorded in sprinting events with only one athlete mounting the podium in the 400m race.

One possible explanation for this challenge is the influence of the physical environment, including limited access to standard sprint tracks, weather conditions, insufficient equipment, and safety-related constraints. These environmental limitations may hinder the proper implementation of competency-based sprint assessments, leading to inaccurate identification of talented sprinters or underestimation of students' true abilities. There is a lack of empirical research examining how the physical environment of The University of Bamenda affects competency-based talent identification outcomes in sprinting. Without such evidence, institutional decisions regarding facility development, resource allocation, and sport policy may not adequately support effective talent identification. This study therefore seeks to address this gap by investigating the role of the university's physical environment in competency-based sprint talent identification.

### **Objectives of the study**

To determine the influence of The University of Bamenda physical environment on competency-based talent identification outcomes in sprinting among students.

#### ***Specific objectives***

To assess the effect of relatively adequate and less relatively adequate physical environments on baseline and post-test competency-based measurements of sprinting competencies for talent identification in The University of Bamenda.

To determine the difference in sprint performance of students before and after exposure to competency-based sprint training in different physical environments in The University of Bamenda.

### **Research questions**

1. What is the effect of relatively adequate and less relatively adequate physical environments on the baseline and post-test competency-based measurements of sprinting competencies for talent identification in The University of Bamenda?
2. How does post-test sprinting performance of students exposed to competency-based sprint training in relatively adequate and less relatively adequate environments differ?

### **Research hypotheses**

H1: There is a significant effect of relatively adequate and less relatively adequate physical environments on the baseline and post-test competency-based measurements of sprinting competencies for talent identification outcomes of students in The University of Bamenda.

H2: There is a significant difference in post-test sprinting performance of students exposed to competency-based sprint training in relatively adequate and less relatively adequate environments.

### **Methodology**

The study adopted a quasi-experimental design, using a competency-based sprint intervention. It was conducted at The University of Bamenda and involved students who do not participate in sprinting activities. The study focused on the physical environment as determinants of competency-based talent identification outcomes in sprinting. It was conducted in a systematic sequence of stages to ensure accuracy, reliability, and ethical compliance in examining the influence of The University of Bamenda physical environment on competency-based talent identification outcomes in sprinting among students. At the preliminary stage, an official authorization from The University of Bamenda was obtained. A meeting was held with Physical Education teachers to explain the purpose of the study, the competency-based intervention procedures, and the roles expected of all stakeholders. The researcher then proceeded

with an identification of different sprinting locations within The University of Bamenda and categorized them based on their physical environmental conditions, such as quality and type of sprinting surface, availability of sprint lanes or marked distances and availability of sprinting equipment. A Physical Environment Assessment Index (PEAI) was constructed from observable indicators. Each indicator was rated on a 5-point Likert scale (1=Very Inadequate, 2=Inadequate, 3=Fairly Adequate, 4=Adequate, 5=Very Adequate). The indicators of physical environment were track surface quality, track markings and lanes, safety conditions, availability of sprinting equipment (blocks, cones, hurdles), and drainage and weather suitability. Based on the results, the sites were grouped into relatively adequate physical environment (The University of Bamenda Main Stadium), and less relatively adequate physical environment (The University of Bamenda makeshift stadium). This categorization formed the basis for group comparison in the quasi-experiment.

In order to select the participants, students at The University of Bamenda who were medically fit (as indicated on their medical certificates issued during their admission), willing to participate and interested in sprinting activities, were selected. Participants were selected using a combination of purposive and random sampling techniques. A total of 40 students were selected for the study. Written informed consent was obtained from all participants before participation. A pre-test was conducted to establish their baseline sprinting performance time in 100 metres, and sprinting competencies (reaction time, acceleration, drive and finish) levels before the competency-based intervention. All tests were conducted following standardized warm-up procedures to minimize injury risk. The warm-up procedures included light aerobic activity like easy jogging and brisk walk, dynamic mobility exercises like leg swings, high knees, dynamic stretching of hamstring and quadriceps. Results from the pre-test were recorded using stop watches. Following the pre-test, a competency-based sprint training and assessment intervention was implemented over a period of eight weeks. The intervention involved task-specific sprint drills focusing on key competencies such as start (reaction time), acceleration, drive and finish, and individualized feedback based on observed competencies. Importantly, the same competency-based intervention was applied across all groups, while the physical environment remained the distinguishing variable.

Throughout the intervention period, the researcher continuously observed environmental conditions and ensured that participants trained and were assessed within their usual physical environments. This step helped to maintain internal validity by ensuring that environmental exposure remained consistent. Two sessions of training were held per day: one session for those in relatively adequate physical environments and the other for the relatively less adequate physical environments. Altogether, two days per week were used for the training. At the end of the two teaching sessions per skill, formative assessments were carried out as post-tests during which the key competencies were measured again and the results recorded to compare them with baseline records obtained during the pretest. At the end of the intervention period, a post-test was conducted using the same sprint test (100m) as the pre-test and the scores were recorded. This allowed for comparison of pre-test and post-test performance within groups, and comparison of post-test outcomes between groups exposed to different physical environmental conditions. Mean gain scores between environments were compared and larger gains indicated stronger environmental influence. Gain Score Improvements noticed in the key competencies and standardized sprint test in 100m were considered favorable for competency-based talent identification.

### **Data Analysis Technique**

The data collected for the study were analysed using both descriptive and inferential statistical tools with the aid of SPSS 27.0. The descriptive statistical tools used were mean and standard deviation while Independent-Sample T-test was the only inferential statistical tool used. The Independent Sample T test was used to compare significant differences in sprinting talent identification outcomes based on environmental factors. Findings are presented using tables and all inferential statistics presented at 95% confidence interval (CL).

## Findings and Discussion

This section presents and discusses the findings of the study on the influence of The University of Bamenda physical environment on competency-based talent identification outcomes in sprinting among students. The results are presented in relation to the study objectives, focusing on differences in 100-metre sprint performance and key sprinting competencies (reaction time, acceleration, drive, and finish) between students trained in relatively adequate and less relatively adequate physical environments. The discussion interprets the findings in light of existing literature perspectives on physical environment, competency-based training, and athletic performance, highlighting the implications for sprint talent identification and development at the university level.

**Objective 1:** To assess the effect of relatively adequate and less relatively adequate physical environments on baseline and post-test competency-based measurements of sprinting competencies for talent identification in The University of Bamenda.

**Table 1: Performance of Students in Less Relatively Adequate Physical Environment.**

Statistical parameters	Reaction time		Acceleration (30m)		Drive (60m)		Finish (30m)	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
N	20	20	20	20	20	20	20	20
Mean	.3455	.2905	5.6205	5.2360	4.9295	4.6045	6.8455	5.3500
Median	.3350	.3000	5.8150	5.2600	4.8750	4.5450	6.9000	5.1900
Minimum	.25	.20	4.49	4.11	3.68	3.50	5.40	4.30
Maximum	.49	.39	6.50	6.06	6.30	5.98	8.27	6.15
Std. Error of Mean	.01575	.00958	.15232	.13803	.19649	.17881	.17054	.11891
Std. Deviation	.07045	.04286	.68119	.61731	.87872	.79966	.76267	.53179

In the less relatively adequate physical environment, results of the sprinting competencies of students showed that for reaction time and at pre-test level, the students' average time was  $0.3455 \pm 0.01575$  seconds, median 0.33 seconds, fastest time 0.25 seconds, and slowest time 0.49 seconds. At post-test level, some improvement in performance was observed with an average time of  $0.2905 \pm 0.00958$  seconds, median 0.30 seconds, fastest time 0.20 seconds, and slowest time 0.39 seconds. For acceleration over 30metres, at pre-test level, the students' average time was  $5.6205 \pm 0.15232$  seconds, median 5.81 seconds, fastest time 4.49 seconds, and slowest time 6.50 seconds. At the post-test level, some improvement was observed with an average time of  $5.2360 \pm 0.13803$  seconds, median 5.26 seconds, fastest time 4.11 seconds, and slowest time 6.06 seconds. For drive over 60metres, at pre-test level, the students' average time was  $4.9295 \pm 0.19649$  seconds, median 4.87 seconds, fastest time 3.68 seconds, and slowest time 6.30 seconds. At post-test level, some improvement was observed with an average time of  $4.6045 \pm 0.17881$  seconds, median 4.54 seconds, fastest time 3.50 seconds, and slowest time 5.98 seconds. Finally, finish over 30metres, at pre-test level, the students' average time was  $6.8455 \pm 0.17054$  seconds, median 6.90 seconds, fastest time 5.40 seconds, and slowest time 8.27. At post-test level, some improvement was noticed with an average time of  $5.3500 \pm 0.11891$  seconds, median 5.19 seconds, fastest time 4.30 seconds, and slowest time 6.15 seconds.

**Table 2: Performance of Students in Relatively Adequate Physical Environment.**

Statistical parameters	Reaction time		Acceleration (30m)		Drive (60m)		Finish (30m)	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
N	20	20	20	20	20	20	20	20
Mean	.3305	.2405	5.5320	4.8930	4.7155	3.8565	6.7255	4.4965
Median	.3200	.2400	5.6850	5.0750	4.5350	3.5900	6.7250	4.4650
Minimum	.27	.21	4.51	4.04	3.55	3.22	5.39	3.62
Maximum	.49	.27	6.40	5.46	6.22	4.89	8.28	5.69

Std. Error of Mean	.01120	.00420	.12925	.10828	.18667	.13122	.16141	.12437
Std. Deviation	.05010	.01877	.57801	.48426	.83483	.58683	.72185	.55619
Coefficient of variation	15.2%	7.8%	10.4%	9.9%	17.7%	15.2%	10.7%	12.4%

In the relatively adequate physical environment, results of the sprinting competencies of students showed that for the start (reaction time), at pre-test level, the students' average time was  $0.3305 \pm 0.01120$  seconds, median 0.32 seconds, fastest time 0.27 seconds, and slowest time 0.49 seconds. At post-test level, the average time was  $0.2405 \pm 0.00420$  seconds, median 0.24 seconds, fastest time 0.21 seconds, and slowest time 0.27 seconds, all lower than at pre-test level. The lower standard deviation of 0.01877 at post-test implies that the students' performance improved (coefficient of variation 7.8%) for reaction time unlike at the pretest level with higher standard deviation of 0.05010 (coefficient of variation 15.2%), twice higher. For acceleration over 30metres, at pre-test level, the students' average time was  $5.5320 \pm 0.12925$  seconds, median 5.68 seconds, fastest time 4.51 seconds, and slowest time 6.40 seconds. At post-test level, the average time taken was  $4.8930 \pm 0.10828$  seconds, median 5.07 seconds, fastest time 4.04 seconds, and slowest time 5.46 seconds, all lower than at pre-test level. The lower standard deviation of 0.48426 at post-test implies that the students' performance improved (coefficient of variation 9.9%) for acceleration unlike at the pretest level with a relatively higher standard deviation of 0.57801 (coefficient of variation 10.4%).

For drive over 60metres, at pre-test level, the students' average time was  $4.7155 \pm 0.18867$  seconds, median 4.53 seconds, fastest time 3.55 seconds, and slowest time 6.22seconds. At post-test level, the average time was  $3.8565 \pm 0.13122$  seconds, median 3.59 seconds, fastest time 3.22 seconds, and slowest time 4.89 seconds, all lower than at pre-test level. The lower standard deviation at post-test of 0.58683, implies that students' performance improved (coefficient of variation 15.2%) for the drive unlike at the pretest level with higher standard deviation of 0.83483 (coefficient of variation 17.7%). Finally, for the finish over 30metres, at pre-test level, the students' average time was  $6.7255 \pm 0.16141$  seconds, median 6.72 seconds, fastest time 5.39 seconds, and slowest time 8.28 seconds. At post-test level, the average time recorded was  $4.4965 \pm 0.12437$  seconds, median 4.46 seconds, fastest time 3.62 seconds, and slowest time 5.69 seconds, all lower than at pre-test level. The standard deviation at post-test of 0.55619 (coefficient of variation 12.4%) higher, implies that the students as their energy was diminishing, they significantly differentiated themselves in terms of resistance.

**Testing of Hypothesis One H1: There is a significant effect of relatively adequate and less relatively adequate physical environments on the baseline and post-test competency-based measurements of sprinting competencies for talent identification in the University of Bamenda.**

**Table 3: Effect of Relatively Adequate and Less Relatively Adequate Physical Environments on The Baseline and Post-Test Measurements of competency-based Sprinting Competencies for Talent Identification.**

Sprint performance indicators assessment	Type of physical environment	Group Statistics				Test statistics
		N	Mean	Std. Deviation	Std. Error Mean	
Reaction time	Relatively adequate physical environment	20	.2405	.01877	.00420	T-value=4.779 p-value=0.000 Mean difference=0.05
	Less relatively adequate physical environment	20	.2905	.04286	.00958	
Acceleration (30 meters)	Relatively adequate physical environment	20	4.8930	.48426	.10828	T-value=1.935 p-value=0.058 Mean difference=0.34
	Less relatively adequate physical environment	20	5.2360	.61731	.13803	
Drive (60 meters)	Relatively adequate physical environment	20	3.8565	.58683	.13122	T-value=3.373 p-value=0.002

	Less relatively adequate physical environment	20	4.6045	.79966	.17881	Mean difference=0.75
Finishing (30 meters)	Relatively adequate physical environment	20	4.4965	.55619	.12437	T-value=4.960 p-value=0.000
	Less relatively adequate physical environment	20	5.3500	.53179	.11891	Mean difference=0.85

\*\*Equal variance not assumed, df=38, CI 95%

Statistically, results showed that the students significantly differ in their sprinting competency-based talent identification outcomes with respect to the type of physical environment ( $p$ -values  $< 0.05$ ). For reaction time, students in relatively adequate physical environment significantly took shorter time at post-test level  $0.2405 \pm 0.00420$  seconds than students in less relatively adequate physical environment  $0.2905 \pm 0.00958$  (T-value 4.779,  $p$ -value  $0.000 < 0.05$ ). For acceleration, the students in the relatively adequate physical environment recorded an average time of  $4.8930 \pm 0.10828$  seconds lower than those in less relatively adequate environment with  $5.2360 \pm 0.13803$  seconds although not significantly lower (T-value 1.935,  $p$ -value  $0.058 > 0.05$ ). More so, at drive, students in the relatively adequate physical environment significantly recorded a shorter average time of  $3.8565 \pm 0.13122$  seconds unlike students in less relatively adequate physical environment with  $4.6045 \pm 0.17881$  seconds (T-value 3.373,  $p$ -value  $0.002 < 0.05$ ). Finally, for finish, the students in the relatively adequate physical environment significantly recorded a shorter average time of  $4.4965 \pm 0.12437$  seconds disparate from students in less relatively adequate physical environment with a  $4.3500 \pm 0.11891$  seconds performance (T-value 4.960,  $p$ -value  $0.000 < 0.05$ ).

Therefore, there is a significant effect of relatively adequate and less relatively adequate physical environments on the baseline and post-test sprinting competency-based talent identification outcomes of students in the University of Bamenda was accepted. This finding that physical environments influence sprinting competency-based talent identification outcomes by enhancing sprinting competencies is grounded in ecological dynamics and talent development research, which emphasizes the functional interaction between athletes and their environments rather than viewing performance as solely an individual trait. In ecological dynamics, skill performance and development are understood as emerging from the continuous interaction between the individual, the task, and the environment. Physical environments (training facilities, track surfaces, equipment quality) act as environmental constraints that shape how perceptual information is available and how movement solutions are selected and stabilized over time. When environments are relatively adequate, they provide richer, more reliable sources of information that a sprinter can detect and utilize to regulate actions and refine technique, supporting both acquisition and assessment of sprinting competence.

This is in line with the opinion of Araujo and Davids (2011, 2018). This finding also aligns with the study by Thomas et al. (2019) which showed that a conducive sporting environment coupled with optimal social and organizational support may have encouraged world-class Caribbean athletes to remain engaged in track and field and to successfully progress within the sport at the junior level. The improvement noticed in the post-test competency-based measurements of sprinting competencies for talent identification, especially in the relatively adequate physical environment in The University of Bamenda can therefore be largely attributed to environmental factors like track surface, lane marking and sprinting equipment. More adequate environments reduce unnecessary variability and constraints (like poor surfaces, inadequate spacing, sprinting equipment), thereby enabling more consistent practice and clearer demonstration of sprint competency during talent identification evaluations. Inadequate environments introduce confounding constraints that may obscure an athlete's potential and make it harder for coaches and talent identifiers to discern true sprinting capability.

**Objective 2:** To determine the difference in sprint performance of students before and after exposure to competency-based sprint training in different physical environments in The University of Bamenda.

**Table 4: Time taken in seconds to run 100 metres at pretest level**

Pretest							
Type of environment	N	Mean	Median	Minimum	Maximum	Std. Error of Mean	Std. Deviation
Less relatively adequate environments	20	16.4815	16.0600	13.16	19.76	.48286	2.15941
Relatively adequate environments	20	16.8035	17.0550	13.65	19.20	.38635	1.72780
Total	40	16.6425	16.7500	13.16	19.76	.30630	1.93719

At pre-test where all the students were under the same environmental factors, the average time taken to run 100metres for those placed in less relatively adequate environments was  $16.4815 \pm 0.48286$  seconds media time 16.06 seconds, fastest time 13.16 seconds and slowest time 19.76 seconds. As for those placed in relatively adequate environment their average time was  $16.8035 \pm 0.38635$  seconds, median time 17.05 seconds, fastest time 13.65 seconds, and slowest time 19.20 seconds.

**Table 5: Time taken in seconds to run 100 meters at posttest level**

Pretest							
Type of environment	N	Mean	Median	Minimum	Maximum	Std. Error of Mean	Std. Deviation
Less relatively adequate environments	20	16.2995	15.9850	13.10	19.34	.47157	2.10892
Relatively adequate environments	20	14.9465	15.1100	12.14	17.22	.33620	1.50352
Total	40	15.6230	15.5700	12.14	19.34	.30567	1.93325

At posttest where the students were placed under different environment with factors respected, the average time taken to run 100meters for those placed in less relatively adequate environments was  $16.2995 \pm 0.47157$  seconds media time 15.9850 seconds, fastest time 13.10 seconds and slowest time 19.34 seconds. And for those placed in relatively adequately environment with the right factors / conditions, their average dropped from 16.8035 to  $14.9465 \pm 0.33620$  seconds, median time 15.11 seconds, fastest time 12.14 seconds, and slowest time 17.22 seconds. This shows that all the students, in a better environment, improved their performance.

**Testing of hypothesis Two H2: There is a significant difference in post-test sprinting performance of students exposed to competency-based sprint training in relatively adequate and less relatively adequate environments.**

**Table 6: Performance of Students Exposed to Competency-Based Sprint Training in Relatively Adequate and Less Relatively Adequate Environments**

Group Statistics						Test statistics (t-test)
	Type of environment	N	Mean (in seconds)	Std. Deviation	Std. Error Mean	
Pre-test	Less relatively adequate environments	20	16.4815	2.15941	.48286	T= -0.521 p-value 0.606
	Relatively adequate environments	20	16.8035	1.72780	.38635	
Post-test	Less relatively adequate environments	20	16.2995	2.10892	.47157	T= 2.336 p-value 0.025
	Relatively adequate environments	20	14.9465	1.50352	.33620	

\*\*Equal variance not assumed, (df= 38, mean difference at posttest =1.3500, F= 6.620, p-value 0.014)

Statistically, results showed that the students significantly differ in their post-test sprinting performance based on the environment. At the pre-test level environments was same for both group of students with no significant difference in the time taken to run 100metres but, at post-test level where environmental factors were completely different, the average time taken by the students under less relatively adequate environment to run 100metres was  $16.2995 \pm 0.47157$  seconds while the average time taken to run the same 100metres for students under relatively adequate environmental factors was  $14.9465 \pm 0.33620$  seconds, which is significantly lower ( $T=2.336$ ,  $p\text{-value } 0.025 < 0.05$ ). Therefore, the hypothesis that there is a significant difference in post-test sprinting performance of students exposed to competency-based sprint training in relatively adequate and less relatively adequate environments was accepted. The difference in this study indicates that relatively adequate physical environment enhances better sprinting performance. This lies in the way external, environmental conditions interact with the biomechanics and physiology of sprinting performance rather than performance being determined purely by individual ability or training alone. Research consistently shows that the quality and mechanical properties of a training surface influence sprint performance outcome.

Surfaces with greater traction, rigidity, and optimal force-return characteristics allow athletes to apply force more effectively during sprinting, which in turn enhances acceleration and velocity. Surfaces that absorb too much force like sand tend to slow sprint performance because less propulsive force is available to the athlete (Sánchez-Sánchez et al., 2020). Also, the environment where training occurs is not just a backdrop, but it actively shapes neuromuscular adaptations and performance transfer. Studies comparing training surfaces indicate that surface type can influence the magnitude of adaptive responses in sprint performance. Although some softer surfaces like sand elicit different neuromuscular demands, they often increase energy cost and change movement mechanics, which may not transfer optimally to competition sprinting performance. Conversely, harder, more stable surfaces enable more specific adaptations relevant to sprint mechanics (Zhang et al., 2024).

Together, these elements indicate that a more adequate physical environment provides mechanical and physiological advantages that support better sprint performance outcomes in competency-based assessments. In The case of The University of Bamenda, the fact that students in relatively adequate physical environments performed better likely reflects a combination of improved force transmission and ground reaction force efficiency because of better traction and surface rigidity, enhancing sprint biomechanics, specific neuromuscular adaptations fostered by surfaces that closely resemble competitive conditions, thereby facilitating skill transfer to the 100 m test and fewer external impediments (uneven ground or excessive energy absorption), which allow athletes to maintain higher speeds throughout the race.

## **Conclusion**

This study set out to examine the role of the physical environment of The University of Bamenda as a determinant of competency-based talent identification outcomes in sprinting among students. The findings clearly indicate that environmental factors play a significant role in shaping sprinting competencies (reaction time, acceleration, drive and finish) and performance particularly following exposure to competency-based sprint training. The post-test results demonstrated that students who trained and were assessed within a relatively adequate physical environment recorded superior sprinting competencies and performance compared with those exposed to less relatively adequate environments. These outcomes can be largely attributed to key environmental elements such as the quality and surface of the running track, availability and appropriateness of sprinting equipment, and the overall conduciveness of the training space. Such conditions appear to facilitate optimal force application, efficient sprint mechanics, and improved execution of sprint-specific competencies, thereby enabling students to better express their sprinting potential during performance assessments.

The findings reinforce the understanding that competency-based talent identification in sprinting is not solely a function of individual physical or technical ability, but rather a product of the interaction between the performer and the environment in which training and assessment occur. A relatively

adequate physical environment provides conditions that support consistent practice, accurate performance evaluation, and fair identification of sprinting talent. Conversely, inadequate environments may constrain performance, potentially masking the true abilities of students and leading to less reliable talent identification outcomes. In conclusion, the physical environment of The University of Bamenda emerges as a critical determinant of sprinting competency-based talent identification outcomes. The study highlights the need for universities and sports institutions to prioritize the development and maintenance of adequate training and assessment facilities as a fundamental requirement for effective talent identification. Improving physical environmental conditions will not only enhance sprint performance outcomes but also contribute to more valid, equitable, and sustainable systems for identifying and developing sprinting talent among students.

### **Implications of the study**

The findings of this study have important theoretical, practical, institutional, and policy-related implications for competency-based talent identification, sprint training, and sport development within university settings, particularly in developing contexts. The study demonstrates that competency-based talent identification outcomes in sprinting are strongly influenced by the physical environment in which training and assessment occur. This implies that talent identification processes that do not account for environmental conditions may misrepresent athletes' true abilities. Institutions relying on sprint performance tests for selection and development should therefore recognize environmental adequacy as a key moderating factor in performance outcomes, avoid making definitive talent identification decisions based solely on results obtained in substandard physical environments and standardize assessment environments to ensure fairness, validity, and reliability in sprint talent identification.

From an educational perspective, the study underscores the importance of learning environments in competency-based Physical Education. Since students' ability to demonstrate sprint competencies depends partly on environmental quality, curriculum planners should integrate environmental considerations into competency-based assessment frameworks, ensure that learning outcomes in sprinting are assessed under conditions that allow students to fully demonstrate competencies. The results have strong implications for institutional planning and resource allocation in The University of Bamenda and similar institutions. Investment in adequate sports infrastructure (standard track surfaces, safe training spaces, and equipment) should be viewed as a strategic priority rather than a luxury, improved physical environments contribute not only to better performance outcomes but also to institutional credibility in sports talent development, and administrators can use evidence from this study to justify funding proposals, partnerships, and facility upgrades.

### **Declaration of No Conflict of Interest**

The author hereby declares that there is no conflict of interest regarding the publication of this study. The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The author further affirms that the design, data collection, analysis, interpretation of findings, and reporting of results were carried out independently and objectively, without undue influence from any organization, institution, or individual.

### **References**

1. Anderson, J. (2020). *Competency-based assessment in sport performance: Theory and practice*. Routledge.
2. Araújo, D., & Davids, K. (2011). What exactly is acquired during skill acquisition? *Journal of Consciousness Studies*, 18, 7-23.
3. Araújo, D., & Davids, K. (2018). The (Sport) Performer-Environment System as the Base Unit in Explanations of Expert Performance. *Journal of Expertise*, 2018. Vol. 1(3).
4. Bourbousson, J., Poizat, G., & Seve, C. (2019). Environmental constraints on performance: A systems perspective. *Journal of Applied Sport Psychology*, 31(4), 407–420.

5. Casey, A., & MacPhail, A. (2018). Adopting a model-based approach to teaching physical education. *Physical Education and Sport Pedagogy*, 23(3), 294–310.
6. Gronlund, N. E., & Hambleton, R. K. (2017). Assessment of educational outcomes: Competency-based approaches. *Pearson*.
7. Henriksen, K. (2010). The ecology of talent development in sport: A holistic ecological approach (Doctoral dissertation). University of Copenhagen.
8. Keith, D., Fabian, O. & Martyn, R. (2021). Adopting an ecological perspective on skill performance and learning in sport. *European Journal of Human Movement*, Vol. 46 (2021).
9. Kevin, T. & Baker, J. (2020). Challenges and [Possible] Solutions to Optimizing Talent Identification and Development in Sport. *Frontiers in Psychology*, Volume 11, 2020.
10. Kirk, D. (2010). Physical education futures. *Routledge*.
11. Li, C., Wang, C. K. J., & Pyun, D. Y. (2014). Talent development environmental factors in sport: A review and taxonomic classification. *Quest*, 66(4), 433–447.
12. Martindale, R. J. J., Collins, D., & Daubney, J. (2005). Talent development: A guide for practice and research within sport. *Journal of Sports Sciences*, 23(9), 891–901.
13. Martindale, R. J. J., Collins, D., & Daubney, J. (2005). Development of the talent development environment questionnaire for sport. *Journal of Sports Sciences*, 23(9), 891–901.
14. Martindale, R. J. J., & Collins, D. (2017). Foundations of sport talent identification and development systems. *Routledge*.
15. McMahon, J. J., & Greene, P. S. (2018). Surface type and sprint performance: Implications for assessment and training. *Journal of Strength and Conditioning Research*, 32(11), 3123–3130.
16. Richards, L. (2017). Designing competency-based education in sport contexts. *Sport Education Press*.
17. Sánchez-Sánchez, J., Martínez-Rodríguez, A., Felipe, J. L., Hernández-Martín, A., Ubago-Guisado, E., & Bangsbo, J. (2020). Effect of natural turf, artificial turf, and sand surfaces on sprint performance: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, 17(24): 9478.
18. Spencer, L. M., & Spencer, S. M. (1993). Competence at work: Models for superior performance. John Wiley & Sons.
19. Spencer, B., & Maxwell, J. (2019). Competency-based instruction and its applicability in sport coaching. *International Journal of Sports Coaching Education*, 5(2), 89–104.
20. Thomas C.E., Chambers T.P., Main L.C., Gustin P.B. (2019). Factors Influencing the Early Development of World-Class Caribbean Track and Field Athletes: A Qualitative Investigation. *Journal of Sports Science and Medicine*, 2019 Nov 19;18(4):758-771.
21. Vaeyens, R., Lenoir, M., Williams, A. M., & Philippaerts, R. M. (2008). Talent identification and development programmes in sport: Current models and future directions. *Sports Medicine*, 38(9), 703–714.
22. Williams, A. M., & Reilly, T. (2021). Talent identification and development in sport: An integrative view. *Routledge*.
23. Zhang J, Wei A, Xie C. (2024). Effects of Sprint Interval Training Surface on Physical Fitness Attributes of Collegiate Female Soccer Players: Identifying Individual Responses to Training on Grass, Sand, and Land Surfaces. *Journal of Sports Science Medicine*, 2024 Jun 1;23(2):465-474.