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The Effects of Mountain Biking as Psychomotor Instrument in Physical Education: Balance's Evaluation

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***Abstract*—**The school physical education is going through several changes over the years, and diversification of its content from specific interests is one of the reasons for these changes, soon, the formality in education do not have to stay out, but needs to open up the possibilities offered by the world, so the Mountain Bike, an adventure sport, offers several opportunities for intervention Its application in the school allows diverse interventions in front of the psychomotor development, besides opening possibilities for other contents, respecting the previous experiences of the students in their common environment. The choice of theme was due to affinity with the practice and experience of the Mountain Bike at different levels. Both competitive as recreational, professional standard and amateur, focus as principle the bases of the Cycling, coupled with the inclusion in the Centre for Studies in Management of Sport and Leisure and of the Southwest Bahia State University and the preview of the modality's potential to help the children's psychomotor development. The goal of this research was to demonstrate like a pilot project the effects of the Mountain Bike as psychomotor instrument in physical education at one of the psychomotor valences, Balance, evaluating Immobility, Static Balance and Dynamic Balance. The methodology used Fonseca's Psychomotor Battery in 10 students (n=10) of a brazilian public primary's school, with ages between 9 and 11 years old to use the Mountain Biking contents. The balance's skills dichotomized in Regular and Good. Regarding the variable Immobility, in the initial test, regardless of gender, 70% (n = 7) were considered Regular. After four months of activity, the Good profile, which had only 30% (n = 3) of the sample, evolved to 60% (n = 6). As in Static and Dynamic Balance there was an increase of 30% (n = 3) and 50% (n = 5) respectively for Good. Between genders, female evolution was better for Good in Immobility and in Static Equilibrium. Already the male evolution was better observed in the Dynamic Equilibrium, with 66.7% (n = 4) for Good. Respecting the particularities of the motor development, an indication of the positive effects of the MTB for the evolution in the balance perceived, necessitating studies with greater sampling.

***Keywords*—**Psychomotricity, balance, mountain biking, education.

I. Introduction

THE transformations that occurred in Physical Education School were not in the past, there is a constant movement for the diversification of its content and creation of new pedagogical strategies. There are several possibilities for interventions, so mountain biking (MTB) is one of these tools aligned with motor development, especially balance.

The development of the child, whether in the school environment or outside the school, is closely linked to psychomotor evolution and have a close relationship between what the child is able to learn (cognitive) and what is capable of performing (motor) [1], so the accompaniment with specific methodologies for the age group will be of great contribution to such development.

Adventure sports show great potential for inclusion in physical education in its most diverse spaces, including in school. The inherent risk and the management of this, make these modalities a fertile field for the association in several areas. A argues that practicing adventure sports can be a risk factor and at the same time a way of adapting to the threats of the daily life [2]. Therefore, the MTB is an adventure sport that promotes risks and challenges, from its foundation, balance, to the highest performance and expertise situations. The MTB has a number of modalities, from the most extreme and fastest downhill, to the most demanding physically like XCM, long distance races and XCO (cross country Olympic), high performance races with many technical obstacles. The Olympic cross-country (XCO) is one of the modalities of "mountain bike" (MTB) performed on narrow and winding tracks called "single tracks" or on open dirt roads, usually with erosions, stones, gravel, Trunks, trees and crossing in stretches with mud [3]. Thus, the motor skills required to practice the MTB go through the satisfactory development of the child throughout its growth process. So, the motor development is a sequential process, related to chronological age, brought about by the interaction between task requirements, individual biology and environmental conditions, inherent to social changes, intellectual and emotional [4].

The activities and interventions associated with psychomotor development must take into account and respect the previous experiences of students in their common environment. The concept of contextualization, "inclusion, valorization of differences and attendance to plurality and cultural diversity, rescuing and respecting the various manifestations of each Community [5].

The choice of theme was due to the affinity with the practice and experience of the sport in its various spheres. Both competitive and recreational on a professional and amateur scale, having as a principle the foundations of cycling, allied to the insertion in the Center for Studies in Sports Management and Leisure (CEGEL) of the State

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University of Southwest of Bahia (UESB). Even the visualization of the potential of the modality in assisting the psychomotor development of children.

The objective of this experience report was to present as a pilot project the effects of Mountain Biking as a tool of psychomotricity in school physical education in the face of the psychomotor skill of balance, evaluating Immobility, Static Balance, and Dynamic Balance.

II. Methodology

The methodology was based on the Psychomotor Battery of Fonseca [6] for analysis of the psychomotricity before and after the semester in 10 students (n = 10), 6 males and 4 females of elementary school, with ages between 9 and 11 years in one Public school in the rural area of Jequié-Ba from the application of the contents of mountain biking. For analysis purposes, the equilibrium variables were dichotomized in Regular (apraxic and dyspraxic) and Good (eupráxicos and hyperpráxicos).

Postural balance is achieved when all the forces acting on the body, both external and internal, are controlled, which allows the body to remain in a desired position (static equilibrium) or moving in a controlled manner (dynamic equilibrium) [7].

The apraxic and dyspraxic profile are the least desirable, the first one is characterized as imperfect, incomplete and uncoordinated performance of the movements in the test, while the second one, with difficulty of control. The eupraxic profile achieved by the proper and controlled performance of motor action, while the hyperpraxic performs the action in a perfect, harmonious and controlled way [8], setting itself up as the most desirable profiles.

The method of action and intervention based on the Motory Praxology, that is the science of the driving action and especially of the conditions, modes of operation and results of its development; this concept supported by the Critical Overcomer approach, which is based on Dialectical Historical Materialism [9].

Thus, the first contact of the children promoted with the instrument on which they would act and by which they would suffer interference, the bicycle. Thereby, the knowledge is treated by five steps, not necessarily chronological logic, thus, Social Practice is the starting point also the point of arrival [10], so the children's initial contact with the bicycle promoted by respecting their common environment and their previous experiences with the instrument of action. However, the point of arrival will not necessarily be the same, because, after the process of problematization, instrumentalization, and catharsis, it returns to social practice, evolved.

For this, a workshop organized to assemble the bicycles, basic repairs and observation of the level of interaction and knowledge of each pupil with the object and its world.

As a basis for observation of the psychomotor patterns, the Fonseca Psychomotor Battery (BPM) chosen. The BPM is not a test in the traditional sense, is a battery of observation that allows the practitioner (educator, teacher, psychologist, therapist, etc.) to visualize many components of the child's psychomotor behavior in a structured way not stereotyped. Identifying children who do not have the psychomotor skills necessary for their learning and development is therefore the goal and purpose of BPM [6].

From the battery, the balance evaluated before and after the interventions in its three valences, Immobility, Static Equilibrium and Dynamic Equilibrium.

After the identification of the psychomotor patterns by the BPM, the performance levels of the motor action with the bicycle were observed to establish the action strategies, so the students were classified into two groups, Level 0 and Level 1. Level 0 – can't Pedal alone. Level 1 - Pedal alone. The evaluation done by observation of the motor action.

The interventions were planned based on the dynamics of action based on the motor skills [11] and the taxonomy of Gentile [12], adapted to the local reality through mountain biking.

It first worked out the gross motor skills - games and games with group work dynamics, promoting non-complex movements, such as running and jumping. Promotion of free pedaling by level 1 group and pedal guided by group level 0.

In sequence, balancing work carried out with and without the bicycle for both levels. Static balance with static and dynamic activities with closed eyes, unilateral pedaling, and static balance with aid and without assistance on and off the bike.

Dynamic balance worked out from open motor skills associated with fine skills. Used double activities, movable cones, seesaw and irregular terrain. Braking and curve work, exchange of bases, narrow bridges and narrow curved bridges. Training of steep descents with obstacles (steps and in curves) in low and high speed.

Bicycles Used - Mountain bike style, 26 "hardtail rim (without rear suspension) and rigid front fork. Material provided by the *Mais Educçação* program of the Federal Government. This program intended to promote extra-class activities at times other than those on the study shift. The *Mais Educação* Program, constitutes a strategy of the Ministry of Education to induce the construction of the integral education agenda in state and municipal education networks that extends the journey School in public schools, for at least 7 hours a day, through optional activities in the macrofields: pedagogical accompaniment; environmental education; sports and leisure; Human rights in education; Culture and arts; Digital culture; health promotion; Communication and use of media; Research in the field of natural sciences and economic education [13].

III. Results and Discussion

The tests performed before the interventions indicated a predominance of the Regular pattern (apraxic and dyspraxic), 70% (n = 7), in relation to the variable Immobility, regardless of genre.

Fig. 1 shows that after four months of activity, the Good (Eupraxic and Dyspraxic) profile, which had only 30% (n = 3) of the sample, evolved to 60% (n = 6). Equilibrium deficiency is an important indicator of cognitive impairment and development. Immobility is defined as the ability to

voluntarily inhibit any movement during a short time [14], confirming the reality observed in these students, in whom it can be perceived great difficulty in staying still.

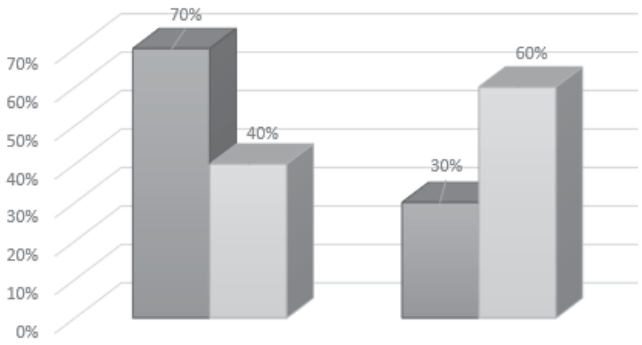

Fig. 1 Psychomotor profile in children of a rural school of Jequié - BA - Comparative between tests of Immobility

Through the assessment of immobility, postural adjustments observed, and the students' anxiety and turbulence noted, which are tonic-emotional reactions [14], may indicate attention and learning deficits. The theories of attention work under two lines, that of central resources and that of multiple resources. Thus, two tasks required in the same source of available capacity and attention, the multiple resources indicate that each resource pool is specific to a skill performance component, but when two tasks played simultaneously and share a common resource, they will not perform as well [11].

Analyzing the immobility deficiency from the central resource theory, observed in the lack of muscle tone, the lacking body schema through the tonic dialog that does not happen in an efficient way to maintain the equilibration. Hence, the hypothesis of a depletion of the central resource reservoir arises, since the contraction and relaxation and postural maintenance of the student is competing for the same resource for the learning of new contents in the classroom, thus, one of the activities undervalued about on the other.

On the other hand, since the multiple resource theory subsidizes an individual reservoir, but limited to each activity, and when performed concurrently competing for a common source, they exhaust it. Thus, providing subsidy to suppose that in this case, muscle tone and the body schema drink from the motor source, therefore learning that is cognitive, also depends on the motor, to maintain the tone of the vestibular system, the vision, the smell, the senses, drinking from the psychomotor source. Therefore, immobility, which is a variable of equilibration, trained to support cognitive processes. Thus, it is possible to notice the evolution of the students presented after intervention with MTB, a strong indicative of the modality and its nuances as a support for the evolution of factors intrinsic to learning.

Mountain biking requires the execution of several simultaneous tasks, from the manipulation of the object to the intertentative variability and open motor skills, thus requiring that regardless of the theory of attention then the reservoirs are trained to work together. Although the primary activity whether to pedal to keep the bicycle in the flow, this is not constant when talking about mountain trails, a factor that can lead to activate at all times other reservoirs.

In the application of the interventions, it is possible to observe the difficulty of concentration of the students, like the fixation of the focus at a fixed point while trying statically balance the bicycle. At the end of the period, the evolution of the static equilibrium was remarkable, the focus of the vision kept at the set point, and simultaneous activities such as counting numbers during the equilibration state became easier to perform. The Static Balance skill presented an evolution from 30% (n = 3) to Good after the interventions, as shown in Fig. 2.

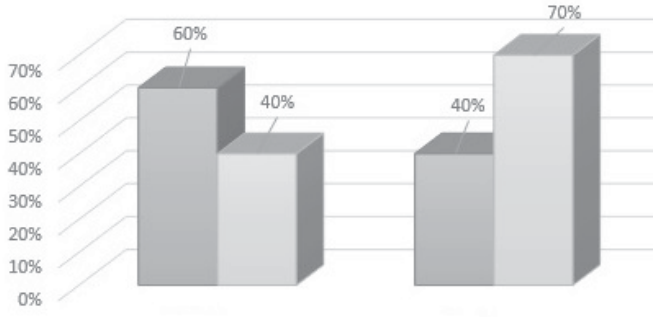

Fig. 2 Psychomotor profile in children of a rural school of Jequié - BA - Comparative between tests of Static Balance

Static balance requires motor capacities similar to immobility, so there is a joint work to evolve these two variables. Static balances require the same capacities of immobility and, in the end, it has exactly the same characteristics and significances described therein. To measure it, three tests Applied: rectilinear support, balance of tiptoe and unipedal support [14].

Therefore, the evolutions in the static equilibrium from the proposed activities like static balancing with the bicycle, unilateral pedaling, tasks with closed eyes, are in agreement with the one proposed by Fonseca [6]. Stability limits during vertical static position considered as the maximum angulation from the vertical that tolerated without loss of postural control [15].

Correct posture and proper functioning of the intrinsic postural muscles are of fundamental importance for good bicycle riding, especially in mountain biking, where there is a wide range of postures required by the terrain. The activities performed with and without the bicycle promoted the recruitment of important muscle groups for balance, core development and body perception. Physiologically, the evolution of the balance aligned to the vestibular system, a set of organs located in the inner ear, characterized as the receptor gravities.

The correct training sensitizes this organ to the variations of the environment and promote evolution in the balance. In order to maintain equilibrium within the limits of stability, the postural control system attempts to reposition the center of gravity by means of body oscillations or adoptions of postural strategies [15]. Therefore, since this system is adaptive, it is

trainable. One of the techniques used is Vestibular Rehabilitation (RV), which represents a valuable therapeutic option for body balance disorders of vestibular origin, acting through mechanisms neuroplasticity centers (adaptation, habituation and substitution) to obtain vestibular compensation [15]. In this way, it can be noticed in the interventions carried out, the training of this system through the activities of balance with the bicycle and especially in activities with the closed eye, evidencing senses besides the vision to increase the stimulus.

This evidenced by the practical observation of the performance of a 10-year-old female student who had evident motor difficulties in gait, knee valgus and balance difficulty in the sagittal plane, as well as cognitive retardation reported by school teachers. With its initiation in the bicycle, deficiency in the spatial orientation, oculomotor coordination and in the dissociation of the movements observed. It evidenced that this student did not know what it meant front or brings with respect to the movement of the limbs corporal.

An individualized strategy had to be set up for this educator. It worked from the primitive movement, the march. From the evolution of the gait with notions of laterality, proprioceptive and coordinative exercises she was readapted the bicycle. Stationary regulatory conditions initially established, without intertentative variability and without body transport, but with manipulation of the object. The strategy was to make her repeat the march in the movement of the pedaling, associating the act of marching forward, with pedaling forward. At the end of the intervention, this student did not acquire independence in the bicycle; however, she had a remarkable evolution in the motor patterns, both pedal and postural, which also reflects in the cognitive evolution.

The dynamic balance was the valence that had the most expressive evolution to Good after the interventions, 50% (n = 5). The environment is not stable, and the context changes during the performance of the skill, which explained by the compensation of previous work with global motor skills, closed and finally open abilities, which requires a lot of dynamic balance [11].

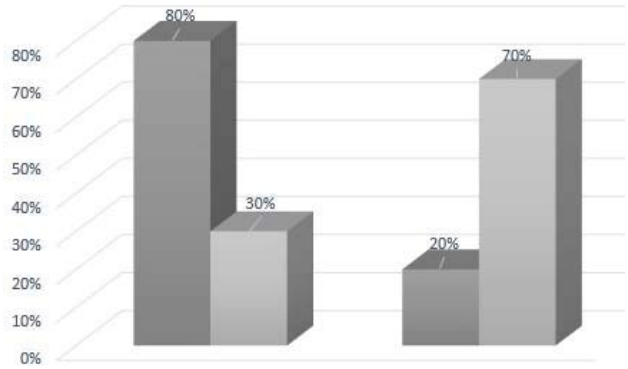

Fig. 3 Psychomotor profile in children of a rural school of Jequié - BA - Comparative between tests of Dinamic Balance

From the Gentile Taxonomy [11] the training of the open abilities characterized by regulatory conditions in movement and with intertentative variability, occurring corporal transport and manipulation of the object.

The use of seesaws was one of the interesting facts, where it allowed the observation of different moments of motor pattern and cognitive relations. First, it was necessary to establish an imaginary line to enter the seesaw, since this was very close. Second, the postural preparation for entry, followed by postural change to promote static balance at the dead-end level of the seesaw, associated with the use of the brakes to keep the bicycle stable, and finally the activation of the intrinsic musculature of the pedal to take the bicycle out of the Seesaw associated with postural change and displacement of the center of gravity.

Several students fell when they reached the dead end of the seesaw in the first attempts; others could not enter the seesaw or could not move the center of gravity to move the bicycle. However, at the end of the interventions, most of the students developed an excellent relationship with the set of specific movement for the seesaw.

Another particular learner drew attention, with more than 11 years old, clearly deficient motor and cognitive patterns, had serious difficulties in open motor skills, in spite of the dexterity in some serial motor skills like to perform wheeling maneuver. He had severe difficulties in immobility and consequent deficit in dynamic equilibrium in situations where the regulatory conditions were in motion with intertentative variability with body transport and manipulation of the object, such as the seesaw and the realization of beacons with base changes. He was a student with a school delay, learning difficulties, lack of interest even for practical activities on mountain bike trails. However, the reaction to the stimuli provided a better interest to the activities, with a significant improvement of the immobility, continuing the dynamic stationary balance, being able to be indicative of the difficulty of the psychomotor development from the 12 years of age.

In the analysis between genders, there was a noticeable female evolution for Good in Immobility, 30% (n = 3), and in Static Balance, 50% (n = 2). Already the male evolution was better observed in the Dynamic Balance, with 66.7% (n = 4) for Good.

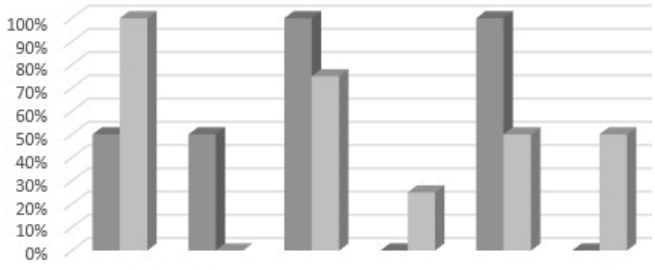

Fig. 4 Psychomotor profile in children of a rural school of Jequié – BA - Comparative between genders on Test 1

The difference between the genders showed a marked evolution of the male relative to the dynamic equilibrium, but since the sample was small, the analysis done under some theoretical lines. Statistically, girls had less evolution,

however, the female sample was smaller (n = 4) and in the comparison between tests a median value, different from the boys, had a high prevalence of the regular pattern in test 1, 100% (N = 6).

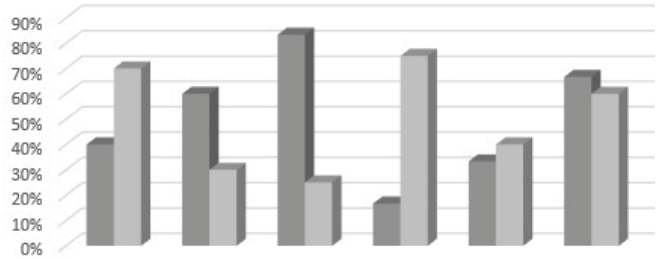

Fig. 5 Psychomotor profile in children of a rural school of Jequié – BA - Comparative between gender on Test 2

Sociologically analyzing the fact that boys evolve more can be explained by the social historical context, based on Bourdieu's Campus theory [16], when all liberty is given to the boys (men), following the local historical logic of the rural zone still under the shadow of Coronelism and patriarchal society. On the other hand, girls (women) deprived of danger to their role as mother and mistress of the home. Thus, allowing boys more freedom experiences, depriving themselves less of the risks. The patriarchal logic, the Campus, and the deprivation of feminine liberty then established, mediated by agents, men, and boys, future men.

IV. Conclusion

Under a qualitative analysis of the data with the particularities of psychomotor development, there is evidence of the effects of Mountain Biking as a tool of psychomotricity to develop balance. The close relationship between cognitive and motor actions reinforces such evidence, since motor development is a sequential process; affected by several variables, time, and space, social, emotional, biological, environmental and emotional context. When observing the general context of the MTB and its manipulation and experience, we can see all these variables interacting with the common object, which allows in the lived experience the requisition of psychomotor skills, at which point we can see the motor evolution. However, to confirm the efficacy of MTB as a tool to evolve the balance, it needs studies with greater sampling.

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