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The Necessity of a Reduced Version of the Psychomotor Battery to Screen for Learning Difficulties in Preschool Children

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Abstract: Psychomotor development is important for effective learning. Therefore, psychomotor observation is essential beginning in preschool education; however, observational instruments require practice, experience and time-consuming procedures. Psychomotor Battery (PBM) is useful to observe children's psychomotor profile but needs 30 to 40 min per child to be applied. Therefore, the main objective of this study was to justify the need of a reduced version of the PBM to enable more frequent psychomotor observations at this level of education. A total of 70 preschool students with typical development were observed over 4 months in a school context, among which 31 were males and 39 were females (4- and 5-year-old). PBM is composed by seven psychomotor factors (PMF) distributed across three neuropsychological functional units. The total average of points for psychomotor observations was obtained using multiple linear regression (MLR) with a Stepwise method. For associations, Pearson's correlation coefficient (*r*) was used. The results of this study showed that it is possible to reduce the average time of psychomotor observation by 43.7% (13 min and 31 s), maintaining a very strong association with the total average of points obtained. This reduction in observation time may contribute to the increase in psychomotor observations of preschool children using PMB.

Keywords: psychomotor development; psychomotor observation; psychomotor deficit; school

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1. Introduction

Psychomotor development plays a key role in the prevention of learning difficulties and psychomotor deficits [1]. Over the years, in the scientific community, there have been many objectives of studies regarding psychomotricity (PM). For Wallon [2], the main objective of the PM would be to verify the relations or dissociations between the motor potential, the affective-relational functions and the cognitive potential, presenting the PM as a modality of re-educational and therapeutic intervention. According to Teixeira [3], PM is the science of thought expressed by the precise, economic and harmonious body, being the product of an intelligible relationship between the child and the environment. Costa [4] considers that psychomotor education is essential for the basic training of the child, regardless of physical or mental condition, to lead them to master their body so that any movement is full of intentionality, considering that it is possible to potentiate the psychic capacities through the training of movement. The Psychomotor Battery (PMB) made it possible to prove a theory centered on the psycho-corporal complexity of the humanization, more specifically, on the phylogenetic, sociogenetic and ontogenetic dimensions, in which it attributes new conceptions to the role of motricity in the structuring and organization of the psyche, behavior and of learning [5].

Though initially the objectives of PM were focused on motor development only, later on, there was a concern to study the relationship between motor and intellectual development of children who had learning problems in reading, writing and calculation [2,5–7]. Often, these children also presented behavioral problems or other conduct disorders, and when submitted to psychomotor re-education programs with emphasis on body mastery, they significantly improved their performance [5]. Therefore, the main objective of PM is the prevention and treatment of problems to enhance in students, not only the motor aspects but all aspects of personality that interrelate, namely, the ones of intellectual, social and affective nature [8–12].

Preschool education (PE) is the first stage of basic education of children and its main aim is to promote their development in cognitive, social, affective, and physical aspects, complementing the actions of the family and the community [13]. Particularly in Portugal, pre-school physical education programs are essentially focused on the educational value of physical activity pedagogically oriented towards the multidimensional and harmonious development of the student, and they can be defined as the appropriation of knowledge and technical skills to increase the capacities of the student and in the formation of skills, attitudes and values [14]. To this end, students should be provided with adequate, intense, healthy, rewarding and culturally significant physical activity [15]. It is intended for children aged between 3 and 6, and it is optional, respecting that it is up to the family in the first place to educate their children. Thus, it is understood that PE is a very important phase in the screening of possible limitations of the child that may not have yet been clinically diagnosed, such as, for example, psychomotor limitations [16–18]. Therefore, PE can serve as an indispensable pillar in the socialization of the child and may also be a decisive moment in the prevention of learning difficulties and, consequently, school underachievement [5,19–21].

A failure in acquiring some skills in PE may result in learning difficulties, and for that reason, it is very important to identify them as early as possible, because a learning difficulty identified by age 3, 4 or 5 is more likely to be overcome. The identification of learning difficulties by age 8 or 9 is less likely to be overcome since, at this age, the child already has a neurological maturation less flexible to change [5,22,23].

Although psychomotor, educational, re-educational and therapeutic interventions have different origins, all of them fundamentally intend to recover, improve and optimize the child's learning potential and psychosocial adaptation [5]. In this sense, it is essential to implement psychomotor observation (PMO) strategies to intervene, regardless of the type of intervention. Thus, PMO is the starting point of the entire intervention process. Even so, it is difficult to reach an infallible interpretation of the observed data only through the PMO. This is because the failure in a motor task may not represent a psychomotor dysfunction, given that it can result from problems with attention, concentration and even motivation [5,7]. In this sense, PMO is indicated to identify minimal deviational signs, not obvious and severe ones that should be diagnosed by neurological exams. However, this type of observation allows one to pick up certain subtle signs that have been overlooked in traditional medical and psychological examinations [19]. The PMO should be seen as a very serious activity, and therefore, the observer must be very experienced [6].

Psychomotor development is not static, it is a process that begins at birth and ends at death, undergoing progressive changes, through the maturation of the central nervous system and the development of the musculoskeletal apparatus [24]. This development is essentially determined by hereditary, organic and environmental factors. In particular, the first three years of life are considered the most important (critical period), and these factors probably explain why children of the same age have different motor performances.

If psychomotor development is a fundamental factor in the prevention of learning difficulties, it is considered that, at least, a PMO should be recommended to be performed on a child in this educational stage by a Childcare Teacher [25]. It is recognized, however, that most of these professionals are not trained in this area and that many of the PMO instruments are very complex, time-consuming and require many materials to be applied [21,23].

The Psychomotor Battery (PMB) by Fonseca [5] is an instrument widely used in the literature [26–29] to diagnose the psychomotor profile (PMP) and then to associate it with learning difficulties. This instrument has many advantages, among which the material resources should be highlighted for being cheap and accessible, as well as a non-invasive administration and easy application of the tasks that compose it [5,7]. These factors, when associated, make for an added value for those who want to perform a PMO on children in PE [5,25]. However, there are some disadvantages for those who want to apply the PMB to PE children, namely, it is a very time-consuming battery, because the average time of its application varies between 30 and 40 min, and it requires a very experienced observer [5]. These may be considered as limitations causing Childhood Teachers to not perform a PMO with the PMB on children in PE. Thus, the present study aims to justify the need for a reduced version of the PMB. The decrease in the average time spent in psychomotor observation (MTS-PMO) in PE children may contribute to the decrease in the degree of fatigue at the end of the test, which may influence the total average of points obtained in the PMB. It was hypothesized that it is possible to reduce the mean time of PMB administration while maintaining a strong association with the original administration.

2. Materials and Methods

2.1. Sample

The non-probabilistic sampling technique by quotas was used for sample collection. The data were collected in the Cristelo School Cluster (Paredes-Porto, Portugal) over 4 months during the 2020/21 school year. The data collection was based on two selection criteria: student's age and profile. As for the age, only 4- and 5-year-old PE students of both sexes were admitted, and regarding the student's profile, only students with typical development were admitted. The study design was determined by the code of ethics [30], the Cristelo School Cluster's authorization was requested and the children's parents were also asked to observe. All procedures followed the tenets of the Declaration of Helsinki for research in humans. The research was approved by the Scientific Board of the Higher Institute of Educational Sciences of the Douro (PMTF:2;24.9.2018). So, the sample consisted of 70 students of the PE, 31 males ($n_{4\ years}$ = 16 children; $n_{5\ years}$ = 15 children) and 39 females ($n_{4\ years}$ = 12 children; $n_{5\ years}$ = 27 children).

2.2. Instrument Used

The instrument used for the data collection was the PMB [5]. Through the PMP classification, the PMB helps to understand behavioral and learning problems of children aged 4 to 12 years, classified as normal or disabled. This instrument consists of a set of tasks that allows for detecting functional deficits in psychomotor terms, but it should not be used to diagnose neurological deficits or brain lesions since it does not provide detailed neurological information [19]. However, there is a possibility to identify children with learning and development difficulties through the observation of the child's movements [5–7].

The movement depends on a set of complex and organized brain systems, where each one performs tasks and responsibilities of the functional unit of the part of the brain in which it is located [5,31]. The author designates this set of systems: The Human Psychomotor System, which consists of 7 psychomotor factors (PMF) distributed through 3 neuropsychological functional units that cooperate in a harmonious and organized way, depending on each other. Hence, each of the units present a different meaning and evolution (Table 1). The neuropsychological model was proposed by Luria [32] and adapted by Fonseca [5] (Table 1) for the construction of the Psychomotor Battery (PMB).

Table 1. Subdivision of the seven psychomotor factors and their subfactors described in the Psychomotor Battery (PMB), according to the three functional units of Luria.

Functional Unit	Psychomotor Factors and Subfactors
First Unit Tonic regulation of alert and mental states: Attention; Sleep; Selection of Information; Regulation and Activation; Vigilance-tonicity; Facilitation-inhibition; Neuro tonic modulation; Intersensory integration.	**Factor**: Tonicity Subfactors: extensibility; passivity; paratonia; diadochokinesia; synkinesis. **Factor**: Equilibration **Subfactors**: immobility; static balance; dynamic balance.
Second Unit Reception, analysis and storage of information: Sensory Reception, Analysis and Synthesis; Spatial and temporal organization; Schematic symbolization; Decoding and coding; Processing; Storage; Receptive integration of proprioceptors and telereceptors; Gnostic elaboration.	**Factor**: Lateralization **Subfactors**: ocular laterality; auditory laterality, manual laterality, pedal laterality. **Factor**: Notion of the body **Subfactors**: kinesthetic sense, left–left recognition, self-image, gestures imitation, body design. **Factor**: Spatial-Temporal Structuring **Subfactors**: organization, dynamic structuring, topographic representation, rhythmic structuring.
Third Unit Programming, regulation and verification of the activity: Intentions; Motor planning; Practical elaboration; Execution; Correction; Sequencing of cognitive operations;	**Factor**: Global Praxis **Subfactors**: manual–ocular coordination, ocular–pedal coordination, dysmetria, dissociation. **Factor**: Fine praxis **Subfactors**: manual dynamic coordination, tapping, speed-accuracy.

Adapted from Fonseca (2021, p 114) [5].

The first functional unit is responsible for regulating cortical tone, vigilance, alertness and the exchange of information between the central nervous system and muscles [31]. This unit is in the medulla, brain stem, cerebellum, thalamus and hypothalamus, and the PMFs that form it are the Tonicity and Equilibration that constitute the pillar of PM [5]. The second functional unit is responsible for receiving, analyzing and storing information from the outside environment (auditory, visual and tactile) [31]. The PMF the unit is composed of are Lateralization, Notion of Body and Spatial-temporal structuring, located in the cortical areas of the occipital, temporal and parietal lobes [5–7]. The third functional unit depends entirely on the previous two units. It comprises the programming, regulation and verification of the activity; that is, it controls the motor planning, execution, correction and sequencing of cognitive operations, and it is located in the prefrontal regions and motor cortex. The associated PMFs are Global Praxis and Fine Praxis [5,31].

Although independent from each other, the seven PMFs function as a whole, since they interrelate and influence each other in the organization and motor planning. In this sense, if there is a dysfunction in an PMF, it will influence the entire Human Psychomotor System [5].

Summing up, PMB consists of 7 PMF, 28 psychomotor subfactors (PMSF) and 47 tasks to be observed. During the tasks of the PMSF, children are given between 1 and 4 points, depending on the specific criteria of each task (Table 2). Thus, the result of the PMSF and PMF is obtained through a rounded mean.

Therefore, the maximum PMB result is 28 points (i.e., 4×7), where the value 4 represents the maximum number of points assigned in the PMF, and 7 is the number of PMF. The minimum result is 7 points (1×7). Depending on the points obtained, the children are classified in a PMP that corresponds to the presence or absence of learning difficulties (Table 3).

Table 2. Results for each Psychomotor Battery (PMB) task (Adapted from [5]).

Results	Performance/Achievement Level	Type of Profile
1 point	Lack of response, imperfect, incomplete, inadequate and uncoordinated execution—very weak, evident dysfunctions, pointing to significant learning difficulties.	Apraxic profile
2 points	Weak performance with control difficulties and deviant signs—mild dysfunctions, pointing to learning difficulties.	Dyspraxic profile
3 points	Complete, adequate and controlled execution—good, not pointing to any learning difficulties.	Eupraxic profile
4 points	Perfect, precise, economical, harmonious and easily controlled execution—excellent, pointing to the facility for learning.	Hyperpraxic profile

Table 3. Classification of the psychomotor profile according to the points obtained in the Psychomotor Battery (PMB) (adapted from Fonseca [5]).

Points in the PMB	Psychomotor Profile	Learning Difficulties
27–28	Excellent	No difficulties
22–26	Good	No difficulties
14–21	Normal	No difficulties
9–13	Dyspraxic	Slight (specific)
07–08	With deficits	Significant (severe)

Abbreviations: PMB—Psychomotor Battery.

2.3. Procedures

The data collection of the PMO was performed by a single observer, professor of Physical Education, apt to administer the PMB (>20 observations made with the instrument). The entire PMO of the children of the PE followed the criteria proposed in the original version proposed by Fonseca [5].

In the context of the problem, the objective of this investigation was to justify the need to reduce the average time spent in PMO (MTS-PMO) with the use of PMB. For this purpose, we studied through the analysis of multiple linear regression (MLR) the PMSF that would most contribute to the total mean of points obtained in the PMO (MTP-PMO) and those that could be excluded from the PMO due to their little influence on MTP-PMO. We also analyzed the association between the degree of fatigability of the child observed at the end of the PMO with the MTP-PMO.

2.4. Statistical Analysis

Descriptive statistics were used to calculate the MTS-PMO of the PMSF, the mean (M) as a measure of central tendency and the standard deviation (Sd) as a dispersion measure. We used the multiple linear regression through the *Stepwise method* for the analysis of the influence of the PMSF on the MTP-PMO. Thus, the F test was used to analyze the linearity of PMSF inclusion in the Models. The model adjustment was evaluated by the variable influence factor (VIF < 10). The R test allowed us to study the association between MTP-PMO and PMSF to be included in MLR, where values of R > 0.9 denoted a very strong association. R^2 indicated the percentage influence that each PMSF represented in the MTP-PMO and $R^2_{(Aj)}$ allowed the study of the variance of the Model when subtracted from R^2, where subtraction values lower than or equal to 0.004 ($\leq$0.4%) allow for generalizing the Model to the general population. The standardized regression coefficients (β) and non-standardized regression coefficients (Beta) analyze the influence that each PMSF would represent in the model. Since the Distribution of the MTP-PMO obtained a normal distribution by the Kolmogorov–Smirnov test (p = 0.200), Pearson's correlation coefficient (r) was used for the association of variables. The magnitude of the correlation was classified as: trivial ($r \leq 0.1$), small (r = 0.1–0.3), moderate (r = 0.3–0.5), large (r = 0.5–0.7), very large (r = 0.7–0.9) and almost perfect ($r \geq 0.9$) [33]. The effect sizes for the regression models were reported using Cohen's f^2 based on $R2_{(Aj)}$: $f^2 \geq 0.02$, $f^2 \geq 0.15$ and $f^2 \geq 0.35$ [34,35]. A significance level was estimated for a $p < 0.05$. The statistical analyses were performed using SPSS for Windows Version 26.0 (SPSS Inc., Chicago, IL, USA).

3. Results

Table 4 presents the descriptive statistics of the MTS-PMO in each of the PMSF.

Table 4. MTS-PMO, in minutes and seconds, for each PMSF.

PMSF	M	Sd	PMSF	M	Sd
Extensibility	1.16	0.09	Imitation of gestures	0.46	0.05
Passivity	0.34	0.04	Body design	1.21	0.04
Paratonias	1.27	0.07	Organization	0.46	0.04
Diadochokinesias	0.42	0.03	Dynamic structuring	1.06	0.25
Synkineses	0.19	0.03	Rhythmic structuring	1.52	0.20
Immobility	0.46	0.30	Ocular–manual coordination	1.03	0.27
Static equilibrium	1.01	0.27	Ocular°pedal coordination	1.31	0.05
Dynamic equilibrium	2.11	0.19	Dysmetria	0.08	0.02
Lateralization (Ocular, auditory, manual and pedal)	1.27	0.08	Dissociation	4.48	0.14
Kinesthetic sense	0.55	0.16	Manual dynamic coordination	2.44	0.05
Right–left recognition	0.27	0.04	Tapping	1.41	0.06
Self-image	0.26	0.02	Velocity precision	2.15	0.24
Total MTS-PMO			31′15″		

Abbreviations: Sd—standard deviation; M—mean; PMSF—psychomotor subfactor; MTS-PMO—mean time spent on the psychomotor observation.

The total MTS-PMO was 31 min and 15 s, with the dissociation PMSF obtaining the highest mean (M = 4.48) and the Dysmetria PMSF the lowest mean (M = 0.08). The Lateralization PMF results from the joint observation of the Ocular, Auditory, Manual and Pedal Lateralization PMSF. The Dysmetria PMSF results from the observation of the ocular–manual coordination and ocular–pedal coordination PMSF.

Table 5 presents the summary of the models of the multiple linear regression (MMLR), obtained through the Stepwise method, to verify which PMSF could be included in the best model, considering the MTP-PMO as a dependent variable.

Based on the analysis of Table 5, it was found that the MLR selected 10 models, where any of them could be valid, given that the F test proved the existence of linearity in all of them ($p < 0.001$), with a very strong positive association with MTP-PMB (R > 0.9), except MLRM 1 (R = 0.855). There was a noticeable low variation since the difference between $R2\text{-}R^2_{(Aj)} \leq 0.004$ in all the MLRMs with a high effect size ($R^2_{(Aj)} = 0.746$ to 0.972) for all variables integrated into the model. These results indicate that if the models were derived from the general population instead of a sample, they would explain values less than or equal to 0.4% of the variance, meaning that these models could be generalized to the general population, which would represent a good validation. Even so, the MLRM 10 was selected by the "Stepwise" method as the one that best suited the objective, as it obtained an almost perfect positive relationship when associated with the MTP-PMB (R = 0.988; $R^2 = 0.976$).

Table 6 shows the coefficients of the best MLRM selected by the Stepwise method (model 10), the PMSF it is composed of and the MTS-PMO in each PMSF.

Table 5. Summary of MMLR depending on the MTP-PMO.

MLRM	R	R^2	R^2 (Aj)	$R^2 - R^2$(Aj)	*F*	*p*
1	0.866	0.749	0.746	0.004	203.225	0.000 *
2	0.926	0.857	0.853	0.004	200.745	0.000 *
3	0.955	0.912	0.908	0.004	228.021	0.000 *
4	0.969	0.939	0.935	0.004	249.268	0.000 *
5	0.976	0.952	0.948	0.004	255.048	0.000 *
6	0.982	0.964	0.961	0.003	283.719	0.000 *
7	0.984	0.969	0.965	0.004	273.900	0.000 *
8	0.986	0.971	0.968	0.004	259.672	0.000 *
9	0.987	0.974	0.970	0.004	251.469	0.000 *
10	0.988	0.976	0.972	0.004	240.040	0.000 *

Abbreviations: * $p < 0.001$; F—F ratio (significance of R^2); MLRM—multiple linear regression models; MLRM 1—Velocity precision; MLRM 2—Velocity precision, Rhythmic structuring; MLRM 3—Velocity precision, Rhythmic structuring, Dynamic equilibrium; MLRM 4—Velocity precision. Rhythmic structuring, Dynamic equilibrium, Extensibility; MLRM 5—Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image; MLRM 6—Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image, Dissociation; MLRM 7—Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image, Dissociation, Laterality; MLRM 8—Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image, Dissociation, Laterality, Synkinesis; MLRM 9—Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image, Dissociation, Laterality, Synkinesis, Dysmetria; MLRM 10—Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image, Dissociation, Laterality, Synkinesis, Dysmetria, Organization; *p*—significance level; R—correlation of PMSF with MTP-PMB; R^2—Influence that PMSF have on MTP-PMB; R^2(Aj)—Adjusted R^2; $R^2 - R^2$(Aj)—explains the generalization of the model.

Table 6. Table of the MLRM Coefficients selected by the "Stepwise" method.

PMSF	β	Sd	Beta	*T*	*p*	VIF	MTS-PMO
Constant	0.177	0.652		0.272	0.786		
Velocity precision	1.196	0.161	0.261	7.410	0.000 *	3.043	2.15
Rhythmic structuring	0.847	0.181	0.165	4.667	0.000 *	3.086	1.52
Dynamic equilibrium	1.010	0.190	0.184	5.316	0.000 *	2.932	2.11
Extensibility	0.573	0.222	0.082	2.581	0.012 *	2.460	1.16
Self-image	0.784	0.210	0.155	3.723	0.000 *	4.265	0.26
Dissociation	0.725	0.172	0.135	4.213	0.000 *	2.519	4.48
Laterality	0.591	0.240	0.095	2.468	0.017 *	3.665	1.27
Synkineses	0.520	0.191	0.093	2.727	0.008 *	2.879	0.19
Dysmetria	0.501	0.164	0.093	3.066	0.003 *	2.258	0.08
Organization	0.364	0.171	0.076	2.125	0.038 *	3.123	0.46

Abbreviations: * $p < 0.05$; PMSF—psychomotor subfactors; β—non-standardized coefficients; Sd—standard deviation; Beta—standardized coefficients; t—T test; p—significance level; VIF—variable influence factor; MTS-PMO—mean time spent on psychomotor observation.

It was confirmed by the analysis of the coefficients that there are no problems of multicollinearity between the PMSF and the MTP-PMO (VIF < 10), so the MLRM presented a good fit. All PMSFs showed a significant influence on MLRM ($p < 0.05$), and the Velocity precision PMSF had the greatest influence (Beta = 0.261 = 26.1%; $p < 0.01$), while the Organization PMSF had the lowest influence (Beta = 0.076 = 7.6%; $p = 0.038$). The MLRM in this study consisted of 10 PMSFs (i.e., Velocity precision, Rhythmic structuring, Dynamic equilibrium, Extensibility, Self-image, Dissociation, Laterality, Synkinesis, Dysmetria and Organization). The MTS-PMO for this MLRM would be 15 min and 28 s. However, since the Dysmetria PMSF results from the observation of the PMSFs Ocular–manual coordination and Ocular–pedal coordination, it would be necessary to add the MTS-PMO of these PMSFs, that is, another 2 min and 33 s, summing up to an MTS-PMO of 18 min and 2 s.

Table 7 shows the PMSFs that were excluded from our MLRM because they did not reveal significance for this purpose ($p > 0.05$). In total, 14 PMSFs were excluded: Body design, Tapping, Kinesthetic sense, Immobility, Manual dynamic coordination, Diadochokinesias, Dynamic structuring, Right–left recognition, Static equilibrium, Passivity, Imitation of gestures, Paratonias, Ocular–manual coordination and Ocular–pedal coordination. As mentioned above, the Ocular–manual coordination PMSF and the Ocular–pedal PMSF would have to be observed to obtain the results of the Dysmetria PMSF, which was included in our MLRM. Thus, the MTS-PMO would be reduced by 13 min and 31 s.

Table 7. PMSF excluded from the best MLRM.

PMSF	Beta In	t	*p*	MTS-PMO
Body design	0.049 [a]	1.137	0.260	1.21
Tapping	−0.002 [a]	−0.039	0.969	1.41
Kinesthetic sense	0.036 [a]	0.921	0.361	0.55
Immobility	−0.001 [a]	−0.021	0.983	0.46
Manual dynamic coordination	0.032 [a]	0.837	0.406	2.44
Diadochokinesias	0.038 [a]	1.091	0.280	0.42
Dynamic structuring	0.032 [a]	1.091	0.280	1.06
Right–left recognition	0.043 [a]	1.450	0.152	0.27
Static equilibrium	0.032 [a]	0.883	0.381	1.01
Passivity	−0.014 [a]	−0.381	0.705	0.34
Imitation of gestures	0.028 [a]	0.884	0.380	0.46
Paratonias	−0.030 [a]	−0.954	0.344	1.27
Ocular–manual coordination	0.020 [a]	0.533	0.596	1.03
Ocular–pedal coordination	0.017 [a]	0.668	0.507	1.31

Abbreviations: a—predictors of the model; *p*—significance level; PMSF—psychomotor subfactors; *t*—T test; MTS-PMO—mean time spent on the psychomotor observation.

Table 8 shows the association between fatigability, PMF and MTP-PMO. Fatigue conveys the overall impression the observer gets of the complete PMO. Although 1 to 4 points are assigned, this observation is not included in the MTP-PMO. The value 1 represents that a child showed clear signs of fatigue and resistance to some tasks throughout the PMO, and the value 4 means that they did not show any signs of fatigue, remaining motivated and attentive throughout the PMO.

Table 8. Association between Fatigability, the PMF and MTP-PMO.

		T	E	L	NB	STS	GP	FP	MTP-PMO
Fatigability	R	0.558	0.680	0.533	0.664	0.684	0.360	0.714	0.776
	p	0.000 *	0.000 *	0.000 *	0.000 *	0.000 *	0.002 *	0.000 *	0.000 *

Abbreviations: * $p < 0.05$; E—equilibration; STS—spatiotemporal structuring; L—lateralization; NB—notion of the body; PMF—psychomotor factors; PG—global praxia; PF—fine praxia; *p*—level if significance; r—Pearson's correlation coefficient; T—tonicity; MTS-PMO—mean time spent on the psychomotor observation.

By the interpretation of Table 8, a significant positive and very strong association between Fatigability, the PMF and the MTP-PMO ($r = 0.776$; $p < 0.001$) was confirmed, with the fine praxia (FP) PMF obtaining the highest association ($r = 0.714$; $p < 0.001$) and the general praxia (GP) obtaining the lowest ($r = 0.360$; $p = 0.002$). These data indicate that the children who showed less fatigue during the PMO were the ones who obtained a better result in the PMF and their MTP-PMO.

4. Discussion

The PMB is widely cited as an instrument to diagnose PPM [26–29]; however, despite the advantages it entails, the MTS-PMO on children varies between 30 and 40 min, making it very time-consuming, even for an experienced observer [5]. It was, then, the main objective of this study to present a proposal to justify the need to reduce the MTS-PMO to make the PMO less time-consuming, maintaining a good degree of reliability and thus leading to its increased use by Preschool Teachers.

This study showed that the MTS-PMO (31 min and 15 s) was in line with the one presented by the author [5]. Thus, to reduce the MTS-PMO, it would be necessary to decrease the number of PMSFs to be observed and the tasks that are associated with them. This study selected an MLRM consisting of nine PMSFs and one PMF (Lateralization), which allowed us to reduce the MTS-PMO by 13 min and 31 s (43.7%), that is, by almost 50%. Thus, the MTS-PMO would be 18 min and 2 s. Since this model revealed a very good validation (R^2 = 0.976), its application can be generalized to the general population ($R^2 - R^2_{(Aj)} \leq 0.004$), representing a good alternative to the complete use of PMB. In addition, the model's feature that all the PMFs were observed allows us to remove the PMP classification and associate it with school learning [5,19,27]. Our children are less and less active [36], with fewer spaces to play and less time to explore them [37]. These data are disturbing because, according to Wallon [2], children develop by movement, from action to representation, from the physical to the cognitive. Pelicier et al. [38] stated that motor and psychological functions are the two fundamental elements of human behavior, initially developing together and later specialized and differentiated, although they remain subject to reciprocal interactions [39,40]. Therefore, psychomotor development depends on the opportunities and interrelations that a child maintains with the environment around them [41]. Given the positive association between learning and psychomotor development [5,20,42], in which the latter represents a fundamental role in academic performance, as set out in the Curricular Guidelines of Preschool Education [41], it is considered essential to evaluate the psychomotor development of children.

Although the preschool teachers assign a very important role to psychomotor development in boosting their students' school learning and grant them proper activities [43], they have difficulties in evaluating their students' psychomotor development [23]. This difficulty is mainly due to the features of the instruments; that is, their administration is usually time-consuming, individual and requires a lot of experience, which results in limitations in relation to the school reality, where this role is transferred only to specialists in the area [23,44]. However, under the current legislation, under which the presence of specialists, namely, psychomotor specialists, is not mandatory at schools (Decree-Law 55/2018 [45]), it becomes very complex for children to have a PMO. Consequently, this task is at the discretion and responsibility of preschool teachers. Although the instruments for the assessment of motor and psychomotor development are an added value for those who want to diagnose the strong and weak spheres of children to detect possible associated learning difficulties and prevent the worsening of future maladjustments through intervention plans appropriate to their characteristics and needs, the instruments' features may become an obstacle [46,47]. In this sense, although PMB is an instrument that requires individual administration and experience by those who apply it [5], a significant reduction in administration time can contribute to a more frequent performance of the PMO by preschool teachers to their students with all its associated benefits.

Another factor studied was the degree of fatigability presented by the children at the end of the PMO, and it was verified that the children who showed greater fatigability presented poorer results. Conceptually, fatigue is the inability to maintain adequate performance during a determined period [48]. It is, therefore, a process of neuromuscular and metabolic origin [49,50], where psychological stress combined with physical stress can result in fatigue, affecting the performance of the tasks [51]. Many studies have proven that fatigue affects the performance of tasks that require a high and lasting cognitive demand, leading to a decrease in the performance and the state of alert in individuals [52–54]. Our results seem to indicate that fatigability could increase as the MTS-PMO increases, which in turn can influence the performance of some tasks and decrease the accuracy of the PMO, conditioning the MTP-PMO and the corresponding PMP. In fact, particularly mental fatigue can play an important role in performing tasks as it can manifest subjectively, behaviorally and physiologically. Indeed, increased tiredness, lack of energy [55], decreased task motivation [56] and decline in performance (e.g., accuracy or reaction time) have been reported as consequences of mental fatigue [57,58]. For these reasons, the data found seem to emphasize the need for a reduction in the MTS-PMO, as the PMP can be affected by childhood fatigue. Thus, the administration of the reduced version of the PMB makes it possible to reduce the MTS-PMO and, consequently, can also contribute to a lower fatigability of children in the PMO, which may enhance the results found. Thus, the administration of the reduced version of PMB allowed us to reduce the MTS-PMO and, consequently, may also contribute to a lower fatigability of children in the PMO.

However, the study is not without limitations. In fact, the PMB is not fully supported by the most recent literature, but we consider that, due to its wide use in Latin American countries, it has the potential to be adapted to satisfy and frame the latest theoretical approaches and ensure ecological validity for the tool. In this sense and considering the small sample size, for the conclusions can be fully generalized and in order to carry out the application of the scale in practice without reservations, further investigations with larger populations are necessary.

5. Conclusions

This study sought to identify a valid model for the reduction in the PMB. However, it is important to mention that if the objective is to obtain and interpret complete and individual results of each PMF and, consequently, classify the associated PMP, the full use of the PMB is recommended. However, if the objective is to classify PMP and associate it with school learning, the results of this study can be very useful for this purpose, as they allow for reducing the time of PMB administration and, consequently, the induced fatigue in children. This study may allow for an increase in the PMO of children in PE with the use of the PMB to identify potential psychomotor deficits as early as possible, allowing a quick intervention, adjusted and appropriate to the child's profile, thus contributing to improve learning. This can be seen as a pioneering study to reduce the time of application of PMB; however, more studies must be developed and similar approaches can be used in other types of batteries existing in the literature.

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