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# Motor development in students of the third year of fundamental education

# Desenvolvimento de motores em alunos do terceiro ano da educação fundamental

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**ABSTRACT**
Among the main proposals of Physical Education (PE) in the early years of schooling is the practice of activities that promote motor skills development of students. The aim of the present investigation was to verify the motor performance level of students regularly enrolled in the third year of elementary school in PE classes. Participated in the research 27 students of both sexes, aged between eight and 11 years (9.5 ± 0.68) from a municipal school located in the city of Seropédica-RJ (Brazil). To measure motor skills, the Test of Gross Motor Development - 2 (TGMD-2) was used. Statistical analysis was performed using the statistical program SPSS (version 24.0). The results showed that the children's motor age was below chronological, both for locomotor and object control skills. Boys showed better results when compared to girls in object control skills. More than half of the students (51%) showed an underperforming motor performance for their chronological age. The present research concluded that the Motor Development (MD) of the investigated students was classified below the expected level for the age group. Therefore, in view of the aspects mentioned greater intervention by physical educators in necessary in order to broaden the motor experiences of the students and the consequent improvement in motor capacity indices.

**Keywords**: Motor Development, Students, Physical Education, Schoolchildren, Motor Skill.

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**RESUMO**
Entre as principais propostas da Educação Física (EF) nos anos iniciais de escolaridade está a prática de atividades que promovam o desenvolvimento das habilidades motoras dos alunos. O objetivo da presente investigação foi verificar o nível de desempenho motor de escolares regularmente matriculados no terceiro ano do ensino fundamental nas aulas de EF. Participaram da pesquisa 27 estudantes de ambos os sexos, com idades entre oito e 11 anos (9,5 ± 0,68) de uma escola municipal localizada na cidade de Seropédica-RJ (Brasil). Para mensurar as habilidades motoras, foi utilizado o Teste de Desenvolvimento Motor Grosso - 2 (TGMD-2). A análise estatística foi realizada por meio do programa estatístico SPSS (versão 24.0). Os resultados mostraram que a idade motora das crianças estava abaixo da cronológica, tanto para as habilidades locomotoras quanto para as de controle de objetos. Os meninos mostraram melhores resultados quando comparados às meninas nas habilidades de controle de objetos. Mais da metade dos alunos (51%) apresentou desempenho motor inferior para a idade cronológica. A presente pesquisa concluiu que o Desenvolvimento Motor (DM) dos alunos investigados foi classificado abaixo do nível esperado para a faixa etária. Portanto, tendo em vista os aspectos mencionados, é necessária maior intervenção dos educadores físicos para ampliar as experiências motoras dos alunos e a consequente melhora nos índices de capacidade motora.

**Palavras-chave:** Motor Development, Alunos, Educação Física, Alunos em idade escolar, Habilidade motora.

## 1 INTRODUCTION

The area currently understood as Motor Development (MD) had its origin in the late nineteenth century and developed from the Psychology and Biology. The MD is concerned with the changes that occur over time in motor behavior. In addition, it also focuses on the motor adaptation processes that occur from the subject's interactions with the environment and the requirements caused by the tasks that are imposed on the individual (Barreiros & Krebs, 2007). Prior to the period highlighted there was a greater emphasis only on biological processes for the evolution of motor skills. However, the influence of the environment for changes in motor behavior was understood and in the last 30 years, many researches have been developed considering also the relationship between environment and MD (Nazario & Vieira, 2014).

According to Gallahue, Ozmun e Goodway (2013, p. 21) the MD can be defined as "[...] The continuous change in motor behavior throughout the life cycle, caused by the interaction between the demands of the motor task, the biology of the individual and the conditions of the environment". Thus, there is a need to maintain motor experiences throughout life for a better development of motor skills. The lack of opportunities for motor practice directly influences the development of children's motor skills.

Currently, there is a reduction in the children's MD. Several studies have pointed to an MD considered "poor" in children located in Brazil and other countries (Abiko, Caruzzo, Bim, Nazario, & Vieira, 2012; Fernandes & Palma, 2014; Rudd *et al*., 2017). Technological advances and violence

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in urban centers are cited as factors that influence the students' MD process. Technological advancement provides children with static games, usually in front of the computer, cell phones and electronic games, reducing the children's active body experience and directly impacting the level of performance of motor skills (Guedes, Neto, & Silva, 2011). Violence in urban centers reduces the spaces and possibilities for coexistence in streets and squares, since those responsible restrict the activities of children in these places. Thus, we observed a reduction in the possibilities for the development of motor skills (Fernandes & Palma, 2014).

In view of the limitations caused by the environment in children's motor skills, school Physical Education (PE) has a lot to favor in improving students' motor performance, especially in the early years of schooling, since in this stage the main motor acquisitions occur that the subject will carry throughout life (Gallahue *et al*., 2013). In addition, the basis of PE, mainly of a developmental character, is based on the development of motor skills of students (Gallahue & Donnelly, 2008).

Understanding the role of PE in the early years of schooling and its importance in stimulating and providing students' MD environments in the acquisition of motor skills, the aim of the present investigation was to assess the level of MD in students of the third year of elementary school.

## 2 METHOD

### 2.1 STUDY DESIGN

In this study, a field research was carried out, considering that the researcher performed data collection with people with different types of resources, in addition to bibliographic research.

> Field studies seek much more to deepen the proposed questions than to the distribution of characteristics of the population according to certain variables. As a consequence, the planning of the field study presents greater flexibility, which may occur even if its objectives are reformulated throughout the research process (Gil, 2008, p. 57).

The research is also characterized by the mixed approach. In this type of research, there is a combination of both quantitative study approaches and qualitative approaches (Johnson, Onwuegbuzie, & Turner, 2007). The study is characterized as qualitative due to subjective criteria for analyzing the data obtained by the TGMD-2 instrument, and quantitative due to the analysis of the results being achieved through descriptive and inferential statistical analysis instruments.

### 2.2 SAMPLE

The sample is characterized as a convenient type, since the researcher routinely frequented the research location to carry out a university program. In this type of sampling "the researcher

selects the elements to which he has access, assuming that they can, in some way, represent the universe" (Gil, 2008, p. 94).

The present study involved the participation of 27 students, 11 boys and 16 girls, aged between eight and 10 years (9.5 ± 0.68) regularly enrolled in the third year of elementary school with a regular PE class, once a week, for 50 minutes. The school is located in the municipality of Seropédica-RJ (Brazil). This research was submitted and approved by the Research Ethics Committee of the Federal Rural University of Rio de Janeiro, under protocol number 23083.003690 / 2016-57.

2.3 INSTRUMENTS

To assess the students' MD, the Test of Gross Motor Development - second edition (TGMD-2) was used. This instrument was chosen because it is widely used in the field of PE, mainly to assess the motor level of children (Abiko *et al.*, 2012; Araujo, Barela, Celestino, & Barela, 2012; Barnett, Minto, Lander, & Hardy, 2014; Brauner & Valentini, 2009; Costa, Nobre, Nobre, & Valentini, 2014; Cotrim, Lemos, Néri Junior, & Barela, 2011; Nazario & Vieira, 2014; Oliveira, Oliveira, & Cattuzzo, 2013; Rodrigues, Avigo, Leite, Bussolin, & Barela, 2013; Silveira, Cardoso, & Souza, 2014; Valentini *et al*., 2008; Visscher *et al*., 2010). Furthermore, the test is highly used in several countries around the world, which provides a comparison of the present investigation with international productions (Issartel *et al*., 2016).

TGMD-2 was developed by Ulrich (2000) with the objective of verifying the motor level of children in the age group between three years and 10 years and 11 months of age. The instrument is subdivided into two categories: locomotion composed of six motor skills (running, jumping, jumping, lateral displacement, vertical jumping and over jumping) and object control, also consisting of six skills (hitting a static ball, dribble, shoot from above, shoot from below, grab and kick)

The instrument, according to protocol, has well-defined evaluation standards and norms, taking into account the performance criteria predetermined by the test. Each skill has between three and five criteria that are scored according to performance or non-performance, with scores 1 and 0, respectively. The instrument was validated for the Brazilian reality with the participation of 3,124 children and the result proved to be reliable for the assessment of the MD throughout the national territory (Valentini, 2012).

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## 2.4 PROCEDURES

The development of the investigation involved the participation of two classes from a municipal school in Seropédica-RJ. In the first moment, the researcher contacted the school management and the teachers of the classes, in order to request the authorization to carry out the research and to clarify them about its objectives and procedures. Subsequently, students were contacted in order to obtain their consent and that of their parents, in addition to clarifying them about the purposes of the study and the tests to be applied in the research.

To carry out the tests, demarcations were made on the school court to separate the 12 stations, six of which were for locomotion and six for object control. All children received information about each test battery before it started, which was the same for all students. Initially, the information was given to the students verbally and then the instructor performed a practical test to demonstrate what should be done, as the test protocol guides. If the student did not understand the task, the instructor performed the verbal and motor instruction again for all students.

After the instruction provided to the students, motor tests started, performed twice according to the protocol. The test was recorded by video. The cameras were positioned to evaluate each performance criterion, changing positions at each motor test. The analysis of the videos was carried out twice and then the arithmetic mean was performed for better reliability of the results.

## 2.5 DATA ANALYSIS

First, we present the descriptive statistics of the data provided by the protocol of the test and then the inferential analysis. The SPSS version 24.0 program was used for statistical analysis. The data did not show a normal distribution for locomotor age and object control given by the Q-Q plot graph and the normal histogram curve. The Shapiro-Wilk test rejected the null hypothesis of normal data distribution with $p < .001$. Not observing the normal distribution of the data, it was decided to use non-parametric inferences. To verify the existence of a correlation between chronological age, object control and locomotor age, the Spearman test was used. Mann-Whitney U test was used to compare the sexes, comparing the median value between the samples. In the comparison between the students' chronological age and the age of locomotion and object control, the Wilcoxon test was used. The level of significance adopted in the present study was $p \leq .05$.

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## 3 RESULTS

The result of the present investigation pointed to a motor delay in the students analyzed, both for the skills of object control and for the skills of locomotion. Table 1 shows the descriptive statistics based on the frequency distribution of the students analyzed in the categories of locomotion, object control and the qualitative assessment of the General Motor Quotient (GMQ). The GMQ is a parameter used in TGMD-2 to check the child's motor behavior in general, taking into account the score of locomotor skills and object control.

**Table 1.** Qualitative evaluation of the motor level of students according to General Motor Quotient, locomotion and object control test.

| Motor Level | General Motor Quotient | Locomotion | Object Control |
|---|---|---|---|
| Very poor | 5 | 3 | 3 |
| Poor | 9 | 4 | 8 |
| Below average | 7 | 7 | 10 |
| Average | 6 | 12 | 6 |
| Above average | 0 | 1 | 0 |
| Higher | 0 | 0 | 0 |
| Much higher | 0 | 0 | 0 |

Source: The author

The data point to poor motor performance in the students surveyed. Based on the evaluation of the GMQ, it was found that of the 27 students analyzed, only six (22.2%) obtained results classified as “on average”, followed by seven (30.4%) classified as “below the average”, nine (33.33%) classified as “poor” and five (18.5%) obtaining the classification “very poor”. The GMQ represents well the motor performance of students, as it is an average value between the skills of locomotion and object control.

The locomotor evaluation showed that of the students investigated, 12 (44.4%) presented their locomotor development classified as “on average”, followed by seven (26%) “below average”, four (14.8%) “poor” and three (11.1%) “very poor”. It is worth mentioning that in this subtest only one student (3%) managed to achieve a classification considered “above average”. In the object control skills, only six (22.2%) had an “average” classification (an expected result for the appropriate age group), followed by 10 (37%) classified as “below average”, eight (29.6%) as “poor” and three (11.1%) obtaining the result of “very poor” classification.

When comparing locomotion and object control skills, better results were observed for locomotion skills, although they were also classified as lower than expected for the age range of the subjects analyzed in the present investigation

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**Table 2** shows the mean and standard deviation of the analyzed tests of locomotion and object control, according to the TGMD-2 protocol, and shows the comparison between these skills and the sex of the students. The values represent the score achieved by the children in the subtests analyzed in mean ± standard deviation. Mann Whitney's U was used to verify whether or not there was a significant difference between genders.

**Table 2.** Comparison between the scores of locomotor tests and object control by sex**.**

| Tests | | Male | Female | U | *p* |
|---|---|---|---|---|---|
| | | (Mean ± SD) | (Mean ± SD) | | |
| Locomotion | Test run | 7,63±1,20 | 6,93±1,61 | 59,5 | 0,162 |
| | Gallop | 5,54±1,21 | 6,31±1,44 | 124 | 0,08 |
| | Jumping | 7,45±1,69 | 7,37±2,89 | 98 | 0,645 |
| | Jump over | 5,54±0,68 | 5,56±0,81 | 94 | 0,79 |
| | Horizontal jump | 5,63±2,54 | 4,56±1,86 | 59 | 0,162 |
| | Lateral displacement | 7,54±0,68 | 6,62±1,89 | 62 | 0,212 |
| Object control | Hitting a static ball | 7,72±1,67 | 4,87±2,39 | 32 | ,005* |
| | Static dribbling | 6,54±0,93 | 5,12±1,78 | 43 | ,026* |
| | Grab | 5,81±0,4 | 5,12±1,14 | 60,5 | 0,178 |
| | Kick | 6,18±1,16 | 4,18±1,64 | 26,5 | ,001* |
| | Throw over | 7,18±1,16 | 5,31±1,99 | 39 | ,015* |
| | Launch from below | 6,36±1,68 | 6,62±1,70 | 95,5 | 0,716 |

* Significance level p ≤ .05. Source: The author

It is observed that there was no significant difference between boys and girls for the locomotive subtests running (U = 59.5 p = .162), galloping (U = 124 p = .08), hopping (U = 98 p = .645) jumping over (U = 94 p = .790), horizontal jumping (U = 59 p = .162) and lateral displacement (U = 62 p = .212). However, it was observed that boys showed better results in object control skills with a significant difference in the following tests: hitting a static ball (U = 32 p = .005), static dribbling (U = 43 p = .026), kick (U = 26.5 p = .001) and throw over (U = 39 p = .015).

To verify the existence of significant differences between the chronological age of the students with the equivalent locomotor age and the equivalent age of object control, the Wilcoxon test was used. Thus, the students' scores were compared to their own age individually. **Figure 1** shows the mean and standard deviation of chronological age, locomotor and object control, using the Wilcoxon test.

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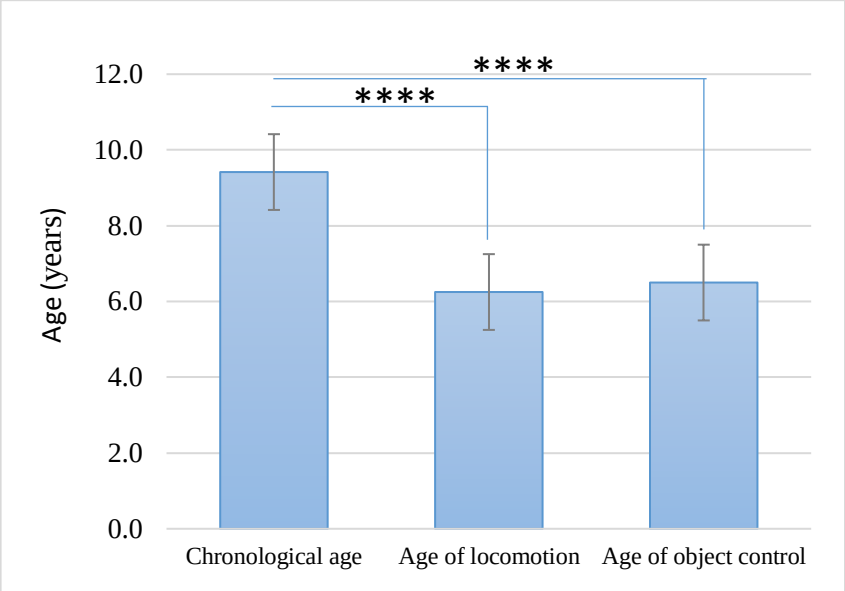
**Figure 1.** The figure represents the mean and standard deviation of the observed values for each variable. A significant difference was found when comparing the chronological age of students with the age of locomotion and object control. There was no difference between the locomotor age and the age of object control. **** p <.0001. Source: The author.




The investigated students had motor performance below the desired level for their age group. The students presented a locomotor age below the chronological age (Z = - 4.407; p <.0001) and the same was seen with the object control skills (Z = -4.409; p <.0001). It is also noted that there was no significant difference between the scores of locomotor tests and those of object control of students related to their chronological age (Z = - .129; p = .905). These results are worrisome with regard to the students' MD, given that the students' motor age is significantly lower than their corresponding chronological age, both for locomotor skills and for object control skills.

**Figure 2** shows the chronological age of the students and their respective ages of locomotion and control of objects individually. It is observed, according to the figure, that the students' motor level was below the expected for their age group, showing a motor delay in both subtests.

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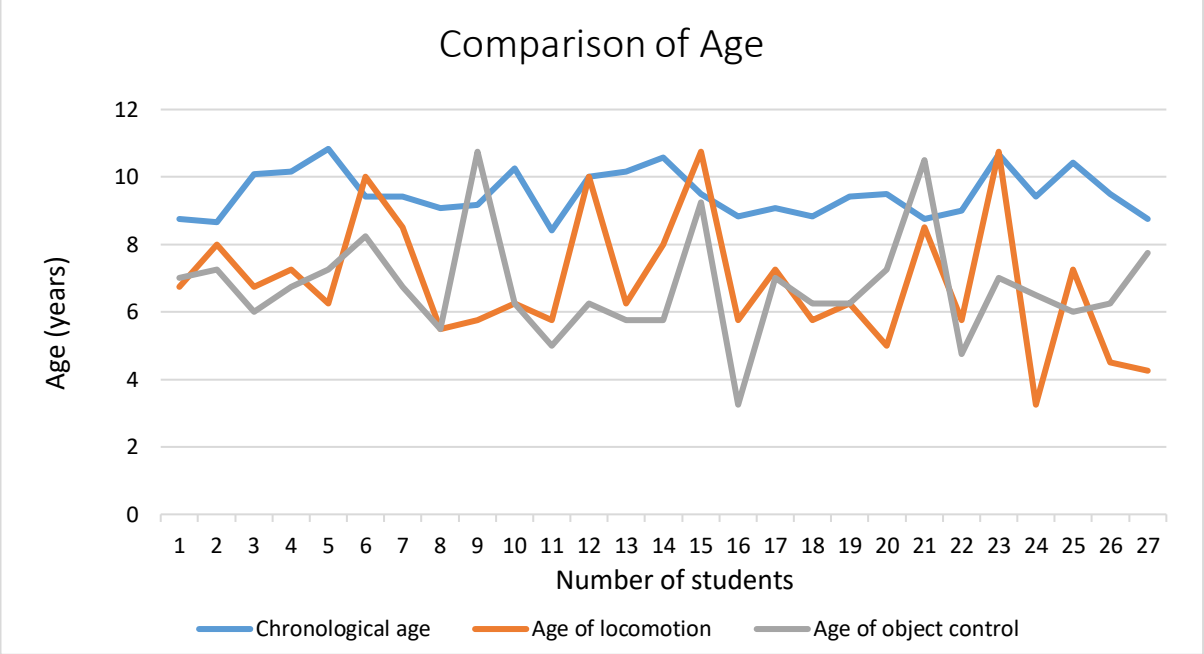
**Figure 2.** Comparison between chronological age, locomotor age and object control age for each student. Source: The author




The results of the correlations showed that there was no directly proportional relationship between the variables equivalent age of object control ($\rho$ = .045 $p$ = .822) and age of locomotion ($\rho$ = - .056 and $p$ = .781) when related to chronological age. These results indicate that an older student will not necessarily have better motor skills when compared to younger ones. There was also no direct correlation between the locomotor age and the age of object control ($\rho$ = - .009 $p$ = .963). These data suggest that a student with a good performance in locomotion skills will not necessarily have better scores in object control skills.

## 4 DISCUSSION

The results show that the MD of the students is below expectations, both for locomotor skills and for object control skills. However, these findings are in accordance with several studies found in the national and international literature.

A survey carried out in Maringá-PR (Brazil) aimed to verify the MD of 145 children aged between six and nine years old. The instrument used to measure motor skills was TGMD-2. The result of the investigation showed that the students presented motor performance classified as "poor", with girls showing greater locomotor skills when compared to boys (p <.001) (Abiko *et al.*, 2012). Unlike the findings of this research, there were no differences between genders in locomotion skills. However, there were better results for males in the skills of object control.

Findings in the literature confirm the difference between the sexes in the evaluation of the MD. When verifying the difference in the level of skills between sex, it was observed that the boys

showed better ability to walk in the tests of running, horizontal jumping, lateral slide and total locomotor score. In addition older children can demonstrate better motor skills when compared to younger children (Oliveira *et al*., 2013).

PE can contribute to the improvement in the development of children's motor skills, given that the basis of the discipline is centered on the movement of students. Checking the importance of PE discipline in the school environment, Araujo *et al*. (2012) pointed out that children who had PE in the regular school grade at least twice a week had an MD within the average established by the assessment instruments adopted in the scientific literature.

Verifying the importance of the PE discipline in the school curriculum, Rodrigues *et al*. (2013) conducted a survey with the objective of comparing the motor performance of 50 children distributed as follows: 25 had regular classes with the PE teacher and 25 with the regular teacher. At the end of the investigation it was observed that the class with the physical educator helped to maintain the fundamental motor skills and increased the practice of students' activities. Children who had classes taught by the regular school teacher showed a reduction in motor skills. These findings confirm the need to include PE in schools with a physical educator.

Diversity in motor experiences is essential for the proper development of motor skills. Children who practice extreme sports classes, for example, have higher levels of motor skills, usually demonstrating an equivalent locomotor age above the chronological age (Araujo *et al*., 2012). In addition it was found that the inclusion of mini basketball helps to improve motor skills (Fotrousi, Bagherly, & Ghasemi, 2012). Thus, it appears that the greater the motor experience of a subject, the greater the tendency to show better motor skills.

The students investigated in the present study had regular PE classes at school at least once a week, 50 minutes of class, by a physical educator. However, as noted, the students had an MD below the expected level for the corresponding age group. It is also noteworthy that the conditions of the environment and the short time of students destined for PE classes must be taken into account.

One of the reasons for the findings can be justified by technological advances, as children are playing in a static way, usually in front of the computer or cell phones. Low MD also ends up harming activities that will be developed in the future, since a greater motor repertoire must be established since childhood (Guedes *et al*., 2011).

Another reason for the low results found is urban violence in cities, as those responsible for children prevent them from carrying out activities on the streets. This deficiency in physical activities negatively influences the acquisition of children's motor skills (Fernandes & Palma, 2014). It is also noteworthy that the municipality of Seropédica does not have leisure spaces suitable for

the practice of physical activity for children, and PE classes are often the only time when they carry out activities that provide improvement in motor skills.

## 5 CONCLUSION

It should be recalled that the main objective of the investigation was to evaluate the MD of students in the third year of elementary school. In general terms, the results pointed to a motor impairment of the students analyzed based on chronological age, in view of a reduced motor equivalence for manipulation and control skills of objects.

Regarding the object control skills, worrying results were observed in the students, mainly due to the minimum number of children who achieved the desirable score in the tests. PE teachers should pay attention to the development of these tasks during their classes and carry out analyzes in order to see what can be improved in their students.

The result of the study pointed out that students had a higher score on locomotion skills when compared to object control skills. One of the reasons for these findings can be found in the greater experience of locomotor activities by children in school environments as running activities.

The sampling criteria were configured as the convenient type. Thus, the students analyzed were part of the same municipality and the students lived close to the investigated school. Finally, it is not yet possible to generalize the results of the investigation to other states or municipalities where the reality of the students is different, requiring more studies.

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