# EFFECTS OF TWO PSYCHOMOTOR PROGRAMMES BASED ON DIFFERENT LEARNING ENVIRONMENTS ON CHILD DEVELOPMENT

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**Abstract:**

The aim of the study was to analyse the effect of two motor intervention programmes, based on two different learning environments, on relevant dimensions in early childhood education: motor development, language development, mathematical thinking, motivation, and character. The research was conducted as a pilot study with children aged 4-5 years, based on a quasi-experimental group comparison design with pretest and post-test. The learning environment of the first group (n = 26) was based on Colombian legends, while the learning environment of the second group (n = 18) was based on the teacher's playful pedagogical project. For data collection a sociodemographic data record sheet, the Utrecht and TEPSI tests, and the EMAPI were used. The results showed improvements in both groups in the explored dimensions, with the most significant changes occurring in the group whose learning environment was based on the teacher's playful pedagogical project. These results confirm that motor intervention programmes in Physical Education have a positive impact on child development in early childhood education.

***Keywords:*** *Physical Education, language development, mathematical thinking development, motivation, early childhood education*

## Introduction

The importance of development during early childhood (prenatal stage up to eight years of age) is crucial for optimal physical and mental growth and well-being (WHO & ⌈UNICEF, 2012). During the last decades, the school environment has prioritized motor activities as a scenario for the promotion of different social skills and emotional competencies, i.e., linking motor development with the different dimensions that make up the infant stage. Thus, numerous studies highlight the importance of motor development in the maturation processes of the infant stage (Cuesta, Prieto-Ayuso, Gómez-Barreto, Barrera, & Gil-Madrona, 2016; Madrid, Prieto-Ayuso, Samalot, & Gil-Madrona, 2016; Saiz, Prieto-Ayuso, Gutiérrez, & Gil-Madrona, 2016).

Accordingly, the development of motor skills is a fundamental tool by which infants develop holistically and can express, integrate, communicate, and live different experiences that will allow them to learn more deeply the world around them, achieving independence and emotional stability, allowing them to discover their own abilities, as well as developing the motor, personal, social, and cultural skills (Gutiérrez, Fontela, Cons, & Rodríguez, 2017).

Studies such as Bodrova, Leong, and Yudina (2023) parameterizes play as a fundamental element in the progress of children's psychomotor, socioemotional and cognitive skills. Additionally, it contributes to the pedagogical practice of teachers and gives the necessary value to playful and corporal learning in a joint way. Therefore, it is important to promote positive physical activity habits from early education, which stimulate motor development and different movements, benefiting the child in the process of their life, and motivating them to be physically active during their life (Stodden, et al., 2008). Hence, the activity from Physical Education in the early childhood education stage becomes a key element for the improvement of children's relationships with the external world (Teixeira, Abelairas, Arufe, & Pazos, 2015).

In this context, the design and implementation of a motor intervention programme can favour the development of children's physical and academic abilities, as teachers can plan, adopt protocols and

generate intervention strategies, both individual and collective, that can enable better motor and academic performance in their students (Vidarte-Claros, Vélez, & Parra-Sánchez, 2018). Following this trend, studies such as those by Cárdenas, Burbano, and Valdivieso (2019) show the positive and significant effects of a motor intervention programme on the coordination skills of preschool children.

Thus, countries such as Spain attach great importance to motor, affective, and social development during the early childhood stage, as stated in the *Decree 80/2022, of July 12, establishing the organization and curriculum of early childhood education in the autonomous community of Castilla-La Mancha* (Department of Education, Culture and Sports of Castilla-La Mancha, 2022). However, in countries such as Colombia and Brazil, despite all the epistemological and legal advances obtained by the reflection on early childhood education in the last decades, it is difficult to recognize the distinctiveness of Physical Education in early childhood education, which discipline is non-existent in the state policies aimed at the subject. Its legality, guaranteed by the legislation in Brazil and Colombia, is not sufficient for its recognition in institutions related to early childhood education (Almeida, da Silva, & Eusse, 2018). Consequently, motor experiences in early childhood education must be firmly grounded, and it is imperative to justify their inclusion in school education, especially during the early years (Gil-Madrona, Contreras, Díaz, & Lera, 2006).

In this regard, Piña, Ochoa, and Sáenz-López (2020) recently demonstrated a positive influence of a Physical Education programme at moderate intensity on motor development improvement in preschool children. Osorio, Piquer, Bartoll, and Capella-Peris (2019) determined the impact of a comprehensive physical activity programme on the gross motor skills of children with functional diversity. The statistical test results showed an improvement in the gross motor skills of the children and highlighted the benefits in cognitive function and learning. Beyond the psychomotor domain, different studies have demonstrated the interrelation between motor and cognitive development, alluding to the systematisation of motor activity as a means of favouring cognitive processes, such as mathematical thinking and language (Macdonald, Milne, Pope, & Orr, 2021; Mas, Jiménez, & Riera, 2018; Zeng, et al., 2017). In relation to the beforementioned, other studies refer to the promotion of psychomotor activities to stimulate active learning and teamwork (Aristizabal-Almanza, Arcelia Ramos-Monobe, & Chirino-Barceló, 2018).

On the other hand, Gil-Madrona (2004) notes that the evaluation in Physical Education can contribute as a preventive element, with the purpose of achieving the most exhaustive knowledge possible of the student's evolution and, therefore, enables adapting the educational process to the child. There is a growing interest in a better understanding of the relationship between psychomotor development and the infant, thus the evaluation of psychomotor skills is a priority in early childhood education because it represents a valuable tool for the teacher to guide relevant and direct lines of action based on the results obtained. Likewise, a motor intervention programme in Physical Education would mitigate risk factors in infants, and for some reasons the adequate development of motor skills provides a way for their adequate intellectual development (Da Fonseca, 1984), facilitating the development of their cognitive and learning competencies. In this context, in a proper integral development of the infant, a good motor assessment is crucial, which involves the implementation of intervention programmes that allow the teacher to design activities that favour the development of skills and attitudes in the students of early childhood education (Monge & Meneses, 2002).

## Methods

The methodology used for the current study is based on a quantitative approach. Regarding the research design, it is a pilot study based on a quasi-experimental design of group comparison, with pretest and post-test measurement in two experimental groups.

### Objectives and hypothesis

*General objective* was to analyse the effects of two psychomotor intervention programmes based on different learning environments in the context of children's Physical Education.

*Hypothesis* was as follows: The psychomotor intervention programmes would produce significant and positive changes in children's motor development, language proficiency, mathematical thinking, motivation, and character.

### Sample of participants

The research sample of the study consisted of 44 students, distributed in two natural groups or classrooms in the last year of early childhood education in a public school in the town of Soledad, Atlantic Department, in the Colombian Caribbean. Group 1 (G1) consisted of 26 students, 50% were boys (n = 13) and the other 50% were girls (n = 13). In turn, group 2 (G2) consisted of 18 students, 50% boys (n = 9) and 50% girls (n = 9). The participants' age ranged from four years and eight months to five years and nine months. The homogeneous distribution of each group was due to circumstantial factors. The sample was a convenient one in terms of access and availability of time, space, and permissions.

## Instruments

*Motivation Scale to Children's Learning EMAPI*. The EMAPI questionnaire (Blanco, 2014, 2017) consists of 22 items, which are distributed as follows: seven items of beliefs and expectations, four items of value, three items of levels of demand, and eight items of attributions. The items are arranged using different pictograms, a resource widely used in early childhood education, since at this stage images have a lot of meaning for the students, making them understand better what is expressed.

The items are answered with different emoticons like smiley faces and sad faces, to specify the agreement or disagreement with what is expressed in the item, or only with smiley faces in the items where they must choose between different suggested options. Likewise, all the items provided to the students are formulated in a positive way, to make it easier to understand and thus to answer. Therefore, the questionnaire is easy to adapt according to the age of the child population. It is administered individually, with an approximate duration of 30 to 45 minutes.

*Character Rubric K-2*. The Character Rubric K-2, which assesses the affective domain through six categories, was used for character assessment. Its use is endorsed by the American Association for Health, Physical Education, Recreation and Dance (AAHPERD), and a professor of kinesiology at the New York University oversaw the translation. For each of the categories, the level in which is the child is selected from five options, with the highest frequency being "consistently" and the lowest frequency being "never". The six categories are: respect, cooperation, sensitivity, leadership, teamwork, and self-control. The score obtained from this test was quantitative, through a 4-point Likert scale, administered individually with an approximate duration of 30 to 45 minutes.

*Psychomotor Development Test (TEPSI)*. The TEPSI (Haeussler & Marchant, 2002) is aimed at a child population aged 2-5 years. This instrument was used to evaluate psychomotor development in the population under study. It consists of 52 items or tasks, which in turn are distributed into three subtests: coordination, language, and motor skills. The coordination subtest, consisting of 16 items, evaluates the child's ability to manipulate objects and draw, through behaviours such as building towers with cubes, threading a needle, and recognizing and copying geometric figures. The language subtest, consisting of 24 items, evaluates aspects of language comprehension and expression through tasks such as naming objects, defining words, and verbalizing actions. The motor subtest (12 items) evaluates children's ability to control their own body through behaviours such as hopping on one foot, picking up a ball or walking on tiptoe. The test is administered individually in an average time span of 30 to 45 minutes, and each response is scored with 0 or 1, depending on whether it is executed incorrectly or correctly, respectively.

*Utrecht Test*. To assess the development of mathematical processes, the Utrecht Test (Van de Rijt, Van Luit, & Pennings, 1999) was used, aimed at the population of children 4-7 years of age. It has three parallel versions of 40 items each. It consists of eight tasks, divided into groups of five. It has a maximum score of 40 points (one for each correct item). It must be administered individually, and its duration ranges between 20 and 30 minutes.

The instrument's dimensions focus on various aspects, such as relational and numerical aspects, which in turn contain four subtests each, assessing various areas such as: comparison, classification, correspondence, and seriation, as well as verbal counting, structured counting, resultant counting, and general number counting. Each of the eight components of the test has five items. Each correct answer is scored with 1 and errors with 0. The maximum score that can be obtained is 40.

The first four subtests (relational: items 1 to 20) evaluate Piagetian-type skills and the last four (numerical: items 21 to 40) estimate numerical skills of a cognitive nature. In this study only the relational aspects were assessed because they are part of the activities that make up the intervention programme. The subtest are comparison, classification, one-to-one correspondence, and seriation.

## Procedure

Before the data collection, the institution ethics and social coexistence committee approved the study. The families signed the informed consent form, indicating the voluntary nature of their children's participation in the study and the confidentiality of the data, in compliance with the necessary ethical requirements.

The implementation of the Physical Education programme for children in G1, called *Se vive la leyenda*, provides a focus and a learning environment inspired by the traditional legends of the different regions that shape Colombia, such us: *el hombre caiman*, *el Sombrerón*, *el tesoro del pirata Morgan*, *la madre monte*, *el Yacuruna*, and *el silbón*. Each region has a variety of stories, therefore, the legend is chosen as a narrative resource to adapt the activities aimed at a child population, to turn them into allied agents in the creation of learning environments for the activities in Physical Education at the early childhood education stage. This motor games intervention programme aimed to promote children's development in the areas of language, motor skills, coordination, relational aspects of mathematical thinking (comparison, classification, seriation, and correspondence), motivation towards learning and character. The

motor games programme for G2 provides its focus on the teacher's pedagogical recreational project. The teacher had four days of pedagogical training, dealing with the importance of motor intervention programmes, sharing material for their implementation, and advising on their possible implementation.

The programmes consisted of 14 sessions and a repeating cycle, i.e., 28 classes, which are implemented over four weeks, with a 50-minute session per day. Similarly, the objectives and contents of the programmes were based on the knowledge areas that constitute early childhood education (see Appendix 1), such as self-knowledge, interaction with others and the environment, and communication and representation. These contents were worked on systematically and transversally throughout the sessions that made up the programmes, in accordance with the curricular guidelines and coinciding with the pedagogical approach in the infant education stage. Thus, the contents are aimed at developing mathematical, perceptual, motor, emotional, sensory-motor, communication, and language skills in the students through the proposed motor tasks, as well as to improve motor skills in early childhood education, such as body control and awareness, locomotion (crawling, rolling, walking, running, jumping, climbing), manipulation and coordination (global, segmental, and dissociated) through motor activities designed for this purpose.

### Data analysis

In this study, as statistical technical references, non-parametric tests were used due to the number of participants in both groups. However, when considering a non-parametric sample, the Hedges' G estimator was applied, since the groups were differently sized, thus, by using this estimator, the standard deviation could be weighted by the number of participants in each group.

As a starting point, a descriptive statistical analysis of the groups and the analyses with the range tests were carried out, followed by comparisons between the two groups. The IBM SPSS statistical program was used for computer processing of the data.

Regarding the effect size (ES), to interpret the result, Cohen (1988) proposed quantifying the magnitude of the effect in three classifications: small (d = 0.20-0.30), medium (d= 0.50-0.80) and high (d= > 0.80). It should be noted that this index can be applied in any estimation to evaluate ES. In this way, ES were explored in each group, in order to evaluate the changes in each subdimension of the scales applied.

## Results

### Results for Group 1

In G1, changes within the EMAPI scale were evaluated (see Table 1). Thereby, in the dimension Beliefs and expectations (Z = - 1.39; p = .165; g = .562) the ES was medium. In the dimension Task value (Z = -.447; p = .655; g = .191) the ES was low. In the dimension Demand values (Z = -2.213; p = .027; g = .054) the ES was low. Finally, in the dimension Attributions factor (Z = -1.085; p = .278; g = .561) the ES was medium.

In the CR scale (see Table 2) changes in each dimension were observed. In the dimension Respect character (1) (Z = -.577; p = .564; g = .153) the ES was low. In the dimension Respect character (2) (Z = .000; p = 1; g = 0) the ES was low. In the dimension Cooperation (Z = -1.414; p = .157; g = .377) the ES was low. In the dimension Sensitivity (Z = -3.217; p = .001; g = 1.095) the ES was high. In the dimension Leadership (Z = -4.472; p = .000; g = 2.226) the ES was high. In the dimension Teamwork (Z = -1.190; p = .234; g = .224) the ES was low. In the dimension Self-control (1) (Z = -3.127; p = .002; g = 1.029) the ES was high. In the dimension Self-control (2) (Z = -2.814; p = .005; g = .877) the ES was high.

In the TEPSI scale (see Table 3) results in the dimensions of the scale were obtained. In the dimension Coordination (Z = -3.547; p = .000; g = 1.305) the ES was high. In the dimension Language (Z = -4.362; p = .000; g = 1.448) the ES was high. In the dimension Motor skills (Z = -4.391; p = .000; g = 1.843) the ES was high.

*Table 1. Effect size of the EMAPI scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Believes and expectations | 26 | 6.0085 | .42937 | -1.389 | .165 | .562 |
| Believes and expectations (POST) | 26 | 5.5769 | .93327 | | | |
| Task value | 26 | 3.2404 | .04903 | -.447 | .655 | .191 |
| Task value (POST) | 26 | 3.2115 | .19612 | | | |
| Demand values | 26 | 2.2915 | .19612 | -2.213 | .027 | .054 |
| Demand values (POST) | 26 | 2.2821 | .12265 | | | |
| Attributions factor | 26 | 5.4377 | .92819 | -1.085 | .278 | .561 |
| Attributions factor (POST) | 26 | 5.9663 | .84525 | | | |

*Table 2. Effect size of the CR scale dimensions (G1)*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Character respect (1) | 26 | 3.9231 | 0.27175 | -.577 | .564 | .153 |
| Character respect (1) (POST) | 26 | 3.9615 | 0.19612 | | | |
| Character respect (2) | 26 | 4.0000 | 0.00000 | .000 | 1 | .000 |
| Character respect (2) (POST) | 26 | 4.0000 | 0.00000 | | | |
| Cooperation | 26 | 4.0000 | 0.00000 | -1.414 | .157 | .377 |
| Cooperation (POST) | 26 | 3.9231 | 0.27175 | | | |
| Sensitivity | 26 | 3.4231 | 0.70274 | -3.217 | .001 | 1.095 |
| Sensitivity (POST) | 26 | 4.0000 | 0.00000 | | | |
| Leadership | 26 | 3.1154 | .32581 | -4.472 | .000 | 2.226 |
| Leadership (POST) | 26 | 3.8846 | .32581 | | | |
| Teamwork | 26 | 3.6923 | .67937 | -1.190 | .234 | .224 |
| Teamwork (POST) | 26 | 3.8462 | .61269 | | | |
| Self-control (1) | 26 | 3.5000 | .64807 | -3.127 | .002 | 1.029 |
| Self-control (1) (POST) | 26 | 4.000 | .000000 | | | |
| Self-control (2) | 26 | 3.4615 | .64689 | -2.814 | .005 | .877 |
| Self-control (2) (POST) | 26 | 3.9231 | .27175 | | | |

*Table 3. Effect size of the TEPSI scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Coordination | 26 | 11.4808 | 2.98262 | -3.547 | .000 | 1.305 |
| Coordination (POST) | 26 | 14.5192 | 0.86508 | | | |
| Language | 26 | 18.7554 | 3.29478 | -4.362 | .000 | 1.448 |
| Language (POST) | 26 | 22.5032 | 1.02882 | | | |
| Motor skills | 26 | 8.0538 | 1.89142 | -4.391 | .000 | 1.843 |
| Motor skills (POST) | 26 | 10.7756 | 0.54913 | | | |

*Table 4. Effect size in the UTRECH scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Comparison | 26 | 3.6385 | 1.01826 | -1.279 | .201 | .330 |
| Comparison (POST) | 26 | 3.9231 | 0.53089 | | | |
| Classification | 26 | 3.4160 | 1.31899 | -1.548 | .122 | .587 |
| Classification (POST) | 26 | 4.0231 | 0.40527 | | | |
| Seriation | 26 | 3.5615 | 1.04922 | -2.029 | .042 | .572 |
| Seriation (POST) | 26 | 4.0385 | 0.36669 | | | |
| Correspondence | 26 | 3.1692 | 1.15474 | -3.208 | .001 | .940 |
| Correspondence (POST) | 26 | 4.0231 | 0.36366 | | | |

In the UTRECH scale (see Table 4), changes were obtained in the dimensions. Thus, in the dimension Comparison (Z = -1.279; p = .201; g = .330) the ES was low. In the dimension Classification (Z = -1.548; p = .122; g = .587) the ES was medium. In the dimension Seriation (Z = -2.029; p = .042; g = .572) the ES was medium. In the dimension Correspondence (Z = -3.208; p = .001; g = .940) the ES was high.

## Results for Group 2

In G2, the following results were obtained from the EMAPI scale (see Table 5). Thus, in the dimension Beliefs and expectations (Z = - 1.925; p = .054; g = .696) the ES was medium. In the dimension Task value (Z = -.816; p = .414; g = .247) the ES was low. In the dimension Demand values (Z = -2.267; p = .023; g = .663) the ES was medium. Finally, in the dimension Attributions factor (Z = -3.179; p = .001; g = .561) the ES was high.

In the CR scale (see Table 6) changes were observed in each dimension. In the dimension Character respect (1) (Z = -.812; p = .417; g = .261) the ES was low. In the dimension Character respect (2) (Z = -1.530; p = .126; g = .499) the ES was medium. In the dimension Cooperation (Z = -2.556; p = .011; g = .909) the ES was high. In the dimension Sensitivity (Z = -3.134; p = .002; g = 1.132) the ES was high. In the dimension Leadership (Z = -2.915; p = .004; g = .992) the ES was high. In the dimension Teamwork (Z = -2.345; p = .019; g = .776) the ES was medium. In the dimension Self-control (1) (Z = -2.859; p = .004; g = 1.000) the ES was high. In the dimension Self-control (2) (Z = -1.671; p = .095; g = .539) the ES was medium.

In the TEPSI scale (see Table 7) results were obtained in the scale dimensions. In the dimension Coordination (Z = -3.080; p = .002; g = 1.130) the ES was high. In the Language dimension (Z = -3.7272; p = .000; g = 2.405) the ES was high. In the dimen-

*Table 5. Effect size of the EMAPI scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Believes and expectations | 18 | 5.3254 | 1.15415 | -1.925 | .054 | .696 |
| Believes and expectations (POST) | 18 | 4.1746 | 1.87711 | | | |
| Task value | 18 | 3.0833 | 0.38348 | -.816 | .414 | .247 |
| Task value (POST) | 18 | 2.9722 | 0.46089 | | | |
| Demand values | 18 | 2.1852 | 0.38301 | -2.267 | .023 | .663 |
| Demand values (POST) | 18 | 1.8148 | 0.63885 | | | |
| Attributions factor | 18 | 4.5069 | 1.04007 | -3.179 | .001 | 1.102 |
| Attributions factor (POST) | 18 | 2.7639 | 1.83456 | | | |

*Table 6. Effect size in the CR scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Character respect (1) | 18 | 3.1667 | 0.92355 | -.812 | .417 | .261 |
| Character respect (1) (POST) | 18 | 2.8889 | 1.07861 | | | |
| Character respect (2) | 18 | 3.0556 | 1.16175 | -1.530 | .126 | .499 |
| Character respect (2) (POST) | 18 | 2.5000 | 0.92355 | | | |
| Cooperation | 18 | 3.1111 | 0.90025 | -2.556 | .011 | .909 |
| Cooperation (POST) | 18 | 2.2222 | 0.94281 | | | |
| Sensitivity | 18 | 3.3889 | 0.77754 | -3.134 | .002 | 1.132 |
| Sensitivity (POST) | 18 | 2.3333 | 0.97014 | | | |
| Leadership | 18 | 2.7222 | 1.22741 | -2.915 | .004 | .992 |
| Leadership (POST) | 18 | 1.6111 | .84984 | | | |
| Teamwork | 18 | 2.7222 | 1.22741 | -2.345 | .019 | .776 |
| Teamwork (POST) | 18 | 1.7778 | 1.06027 | | | |
| Self-control (1) | 18 | 2.9444 | 0.93760 | -2.859 | .004 | 1.000 |
| Self-control (1) (POST) | 18 | 2.0556 | 0.72536 | | | |
| Self-control (2) | 18 | 2.8333 | 0.98518 | -1.671 | .095 | .539 |
| Self-control (2) (POST) | 18 | 2.2778 | 0.95828 | | | |

*Table 7. Effect size in the TEPSI scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Coordination | 18 | 11.1111 | 3.49866 | -3.080 | .002 | 1.130 |
| Coordination (POST) | 18 | 7.3194 | 2.79006 | | | |
| Language | 18 | 19.3079 | 2.97605 | -3.727 | .000 | 2.405 |
| Language (POST) | 18 | 12.3565 | 2.44925 | | | |
| Motor skills | 18 | 8.0926 | 1.94384 | -2.928 | .003 | .936 |
| Motor skills (POST) | 18 | 6.0880 | 2.09213 | | | |

*Table 8. Effect size in the UTRECHT scale dimensions*

| | N | Average | SD | Z | p | Hedges' g |
|---|---|---|---|---|---|---|
| Comparison | 18 | 2.6444 | 1.66706 | -.035 | .972 | .014 |
| Comparison (POST) | 18 | 2.6667 | 1.23669 | | | |
| Classification | 18 | 3.0556 | 1.31383 | -2.683 | .007 | .813 |
| Classification (POST) | 18 | 1.8778 | 1.41611 | | | |
| Seriation | 18 | 2.9529 | 1.32765 | -1.567 | .117 | .491 |
| Seriation (POST) | 18 | 2.2556 | 1.34917 | | | |
| Correspondence | 18 | 2.6444 | 1.39841 | -1.260 | .207 | .427 |
| Correspondence (POST) | 18 | 2.0706 | 1.12237 | | | |

sion Motor skills (Z = -2.928; p = .003; g = .936) the ES was high.

In the UTRECH scale (see Table 8), changes were obtained in the dimensions. Hence, in the dimension Comparison (Z = -.035; p = .972; g = .014) the ES was low. In the dimension Classification (Z = -2.683; p = .007; g = .813) the ES was high. In the dimension Seriation (Z = -1.567; p = .117; g = .491) the ES was medium. In the dimension Correspondence (Z = -1.260; p = .207; g = .427) the ES was medium.

## Discussion and conclusions

The data analysis carried out allows us to respond to the objective of this study, which is focused on analysing the effects of the motor intervention programmes on the motor development of children aged 4 to 5 years; specifically, on the aspects of child development such as language, relational aspects of mathematical thinking (seriation, classification, correspondence and comparison), motivation towards learning and character.

The results show that the programme in G1, in general, produced significant improvements in 12 out of the 20 aspects evaluated. However, the programme did not produce greater improvements than the Physical Education classes programmed by the teacher of G2, since in the latter programme improvements were produced in 16 out of the 20 aspects evaluated, and the significance in 14 of them was greater than in G1.

When examining whether the motor intervention programme *Se vive la leyenda* improved some aspects of motivation towards learning, considering the analysis carried out and the evaluation of each of the components that structured the test, it can be concluded that there was an improvement in two out of the four dimensions, being beliefs and expectations and attributions factor. In contrast, in G2, the motor programme based on the teacher's pedagogical recreational project resulted in improvements in the dimensions beliefs and expectations, demand values and attributions factor. Moreover, these improvements were more significant than those produced in G1.

The low effect on components such as task value and demand values in G1 is recognized, implying the need for revision of the contents and the little promotion of these components in the activities carried out. In this line, Blanco (2014) mentions that motivational patterns are established at an early age and the first years of life are crucial for the establishment of solid intrinsic motivational orientations that will last for a lifetime. The findings also highlight the role of the school as a promoter of motivating motor scenarios that stimulate the practice of physical activity in early childhood education (Hernández-Martínez, González-Martí, Sánchez-Matas, & Carrión-Olivares, 2020).

Inquiring whether the effects of the motor intervention programmes improve motor development in terms of some components of character, it was concluded that in G2 there were more significant effects than in G1, with the former showing improvements in the components of character, cooperation, sensitivity, leadership, teamwork, and self-control, while in the latter there was only a high and direct effect on the components of sensitivity, leadership, and self-control. It should be noted that in the self-control component, the improvements were greater in G1.

Accordingly, Aldana Sánchez (2020) points to the promotion of programmes aimed at strengthening well-being within school contexts, based on the development of skills and character strengths, thus suggesting the need for school intervention in these early stages of personal development. In other words, the execution of motor intervention activities improves some aspects of emotional self-regulation in childhood. All this partially validates the hypothesis presented in this study that there are significant and positive changes in motor development depending on some aspects of character. However, it can be concluded that properly planned, conducted and developed physical activity has a positive influence on the components of character, which can have an impact on health and well-being (Klavestrand & Vingård, 2009; Ohrberg, 2013; Warburton, Nicol, & Bredin, 2006).

Furthermore, when verifying whether the motor intervention programmes improve language, the results show that both groups achieved a highly significant improvement. This means that motor interventions have an impact on child's development, causing significant and positive changes in language.

Meanwhile, several investigations agree on stating that the psychomotor system positively influences the development of language and its production (Gonzales-Remigio, 2022; Kiat-Hui & Ee-Lynn, 2021; Mendiara, 2008; Teixeira, et al., 2015). This is how Physical Education meets the required characteristics to be a good educational resource where movement and language become the essential tools for a good development of skills at school age that should serve in adult life (Cañabate, Colomer, & Olivera, 2018). Therefore, collaboration from Physical Education to produce improvements not only in motor skills but also in language, implies that children's intervention programmes should emphasize combining different play strategies that incorporate movement, in order to enhance the proper development of motor skills (Vargas-Vitoria, et al., 2021).

When testing whether the intervention programmes have an impact on the improvement of mathematical development and relational aspects (such as seriation, classification, correspondence, and comparison), it should be noted that in G1 low scores were obtained in the comparison aspect, as opposed to medium scores in the classification and seriation aspects, and high results in correspondence. In this sense, the effects in G2 were similar, where low scores were obtained in the comparison aspect, high scores in classification, and medium scores in seriation and correspondence. Similarly, although in G2 there was a greater effect in the classification aspect, in G1 there was a greater effect in the correspondence aspect. This means that some progress was found in the relational aspects of mathematical development.

It is therefore noted that there is a positive effect on the improvement of mathematical development in G1. However, it is important to examine the proposed activities oriented to the comparison component in the improvement of the programme and future applications. In accordance with the foregoing, motor activities provide great help in the development of maturity, acquisition, and rehabilitation in the area of calculation, as stated by Hernández, de los Ángeles, and Vilugrón (2019). In addition, recent studies show that there is a direct, positive, and highly significant relationship between psychomotor development and basic mathematical notions (Quispe, 2021). Alonso and Pazos (2020) reveal the importance of motor practice in the integral education of the infant, further ratifying the need for the implementation of motor programmes due to their effects on the development of children as a complement and follow-up to the results of this research.

To conclude, the limitations of this study include the sample size, the convenience sampling method and the absence of a control group, which could limit the generalisability of the study results. However, this study supposes the beginning of a line of research poorly studied, given the scarce research linking the variables of motor intervention, motor development, coordination, motivation towards learning, character, language and relational aspects of mathematical development in early childhood education through the region's own cultural heritage. In this regard, Blanco (2017) highlights the precariousness of studies linked to motor skills, determinants of motivation and different aspects in early childhood education. Therefore, this study could serve as a foundation for future studies linking these variables.

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# Appendix 1.

*Table 9. Structure of the programmes*

| Transversal curricular contents | | |
|---|---|---|
| **Area** | **Block** | **Content** |
| Area of self-awareness and personal autonomy | Block 1. The body: image and health | Body knowledge: parts of the body, identity, exploration of one's own body and others, care and hygiene habits.<br>Postural control of the body and movement, coordination, balance and breathing.<br>Identification and management of emotions, own and others' feelings. |
| | Block 2. Play and daily activity | Play: construction of and respect for rules and norms, initiative and personal effort, non-discriminatory attitudes.<br>Activities of daily life; habits and behavioural patterns, conflict resolution, social relations and positive attitudes, coexistence. |
| Area of knowledge and interaction with the environment | Block 1. The approach to the natural environment | Moving and exploring, objects and their manipulation, both with care and protection orientations |
| | Block 2. Participation in cultural and social life | Social groups, school. Behavioural patterns. Culture and oral tradition. Dialogue as a conflict mediator. |
| Language area: Communication and representation | Block 1. Verbal language | Communication skills, speaking and listening<br>Comprehension of the spoken word<br>Participation in and use of language exchange norms. |
| | Block 2. Creative languages | Physical-motor expression.<br>Body resources,<br>Expression of emotions and feelings<br>Legends, rhythms and dances,<br>Spontaneous representation and symbolic play.<br>Fine motor work techniques.<br>Logical-mathematical thinking |
| | Block 3. The language of information and communication technologies | Audiovisual productions |