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Original article

Systematic Review of Didactic Strategies in Physical Education to Develop Motor Skills

[*Revisión sistemática de las estrategias didácticas en la Educación Física para el desarrollo de habilidades motrices*]

[*Revisão sistemática das estratégias de ensino em Educação Física para o desenvolvimento das habilidades motoras*]

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ABSTRACT

Introduction: The practice of basic motor skills during infant learning helps articulate and enhance the basic motion abilities through Physical Education. These actions are then conceptualized and strengthened into more complex motor skills, such as movements, jumps, balances, throwing, and catching.
Aim: to conduct an analysis of didactic strategies used in Physical Education to tackle basic motor skills.
Materials and methods: the main method used was systematic review, under the PRISM method design, and the practical guide for systematic reviews regardless of meta-analysis.
Results: The most outstanding results were observed in 4 studies, using a version of theoretical and empirical methods suggested by other authors.
Conclusions: Physical Education is the main axis to build infant motor skills, used as the denominator of motor and cognitive development. It lies within the body concepts in favor of anatomical gesture movement during their life cycle.

Keywords: Motor skills, physical education, didactic strategies.

RESUMEN

Introducción: la práctica de las habilidades motrices de base en el desarrollo del aprendizaje infantil articula y emancipa las destrezas básicas de movimiento, desde la Educación Física formativa se conceptualizan y fortalecen dichas acciones motrices más complejas, como es el caso de los desplazamientos, saltos, equilibrios, lanzamientos y recepciones entre otros.
Objetivo: realizar un análisis de las estrategias didácticas que se utilizan en la educación física para trabajar las habilidades motrices de base.
Materiales y métodos: la metodología desarrollada es la revisión sistemática, bajo el diseño método PRISMA y la guía práctica referida a las revisiones sistemáticas con o sin meta análisis.
Resultados: Los resultados más destacados se obtuvieron en 4 estudios empleando una versión de métodos nivel teórico y empírico propuesto por otros autores.
Conclusiones: se puede concluir que la Educación Física es el eje central como denominador del desarrollo motriz y cognitivo en la construcción de las etapas del desarrollo motriz en el estadio infantil de los seres humanos, enmarcando las conceptualizaciones corporales en pro del movimiento anatómico y gestual para su ciclo de vida.

Palabras clave: Habilidades motrices, educación física, estrategias didácticas.

RESUMO

Introdução: a prática das habilidades motoras básicas no desenvolvimento da aprendizagem das crianças articula e emancipa as habilidades básicas do movimento, da Educação Física formativa essas ações motoras mais complexas são conceitualizadas e fortalecidas, como é o caso do movimento, pular, equilibrar, arremessar e pegar, entre outros.
Objetivo: realizar uma análise das estratégias didáticas utilizadas na educação física para trabalhar as habilidades motoras básicas.
Materiais e métodos: a metodologia desenvolvida é a revisão sistemática, sob o método de projeto PRISMA e o guia prático referente às revisões sistemáticas com ou sem meta-análise.
Resultados: Os resultados mais notáveis foram obtidos em 4 estudos utilizando uma versão de métodos de nível teórico e empírico propostos por outros autores.
Conclusões: Pode-se concluir que a Educação Física é o eixo central como denominador do desenvolvimento motor e cognitivo na construção das etapas de desenvolvimento motor na fase infantil do ser humano, enquadrando as conceitualizações corporais em favor do movimento anatômico e gestual para seu ciclo de vida.

Palavras-chave: Habilidades motoras, educação física, estratégias didáticas.

INTRODUCTION

The practice of basic motor skills during early infant learning, lead to the formation of further more complex motor skills, such as movements, jumps, balances, throwing, and catching. According to Guthrie (2019, p. 3), it is the capacity of achieving the expected results accurately, through learning, usually, in the shortest possible time, with the least energy consumption. It permits children to adapt to neurophysiological processes by means of stimuli, thus providing a positive result. Through different types of ludic activities, children can experience new moments in their lives.

Thanks to the analysis of theoretical and empirical studies, motor development in children is understood as the motor aptitudes experienced by the children. Hence, motor movements are increasingly special gestures that can be performed with their bodies, which is known as thin and thick motricity. (Bernate, 2021). To Piaget, "Intelligence is built through motor activity in the early ages, and until age seven, approximately, when child education is psychomotor." (n/a) It shows that child evolution relies on the dexterities acquired every year.

(Bernate *et al.*, 2019 p. 34) "referred to thin motricity, which is developed through the logical and systematic method as the capacities to perform all the tasks needed throughout their school life, which help meet their goals as a component of comprehensive education", besides representing a success on the intellectual, social, and sentimental circles. In turn, Vivas, (2015) noted that it requires education that forms and develops, consolidating the utilization of small and precise handling movements through the sports games, thus familiarizing the children with the sports skills. Thin motricity is a set of abilities that the children acquire mainly by using their hands, which require hand-eye coordination, such as "painting, amassing, grabbing, and using tools, between 1 and 3 years of age" (Vivas, 2015 p. 12)

Thick motricity can be materialized through actions performed with the whole body, coordination movements, such the limbs, balance, and the senses, such as walking, running, turning, and jumping, between 2 and 5 years of age, when the children make the most progress, and with the help of science, they must have been well adapted to these activities.

Renzi (2013, p.3) noted that in early infancy, children learn to be motor competent when they are capable of understanding better all the situations demanding effective motor performance, and when they develop resources needed to respond to the challenges of a particular situation. It entails the development of a feeling of competence to act, like "I can", along with the confidence to overcome difficult-problematic situations. It also is reflected in the satisfaction of transforming the settings.

Several loco-motor and handling skills can be identified, considering that motor skills are the dexterities developed by infants for complex activities necessary for a wide variety of challenges throughout their lives, such as games and sports.

First, the relevance of games in the development of motor skills is very important; Monzón (2010) claims that, "Games meet certain psychological, social, and pedagogical needs, and permit the development of a broad variety of dexterities, skills, and knowledge."

Cabrera & Dupeyrón (2019) define emotion as the reaction of the body to the mind. Motricity becomes a principal plane for cognitive, emotional, social, and affective development in children, in school, public places, and their homes. Therefore, its factors have been demonstrated when exploring things, whose motricity can be developed through games. Besides, it can be implemented through pedagogical proposals inside and outside schools during the early stages, with the ultimate objectives of motor and cognitive skills, thus improving school achievements. Physical interaction will help the children recognize themselves and develop cognitive and motor skills that can provide better ways to solve everyday problems.

Meanwhile, Rojas *et al.* (2019) corroborated the importance of the child's integrated development in pre-school education; they are a reflection of how parents and educators do not pay due attention to activity, and on many occasions ignore the biological, morphological, and social landmarks of motricity through Physical Education. Although there are quite a few scholars conducting studies related to the significance of motor education, the educational and curricular processes fail to overlap and articulate. Often, school development is hindered by means of body development, motor expressions, and the awareness of the body and development of motor and coordinating capacities.

> "When children are capable of using symbols, words, or objects to replace what is absent (during their second year of age), they are proving that they can act differently, not only physically, on the things that surround them" (Mármol *et al.*, 2015 p. 3).

Consequently, Delgado & Montes (2017) described the way in which some educators disregard motor education in early ages, perhaps because they do not have enough expertise and specialized training, which may also be caused by the fact that to most, body and motor education is not as relevant as other educational areas. Besides, when motricity lacks efficiency and purpose, it creates conceptual gaps in learning. "The locomotor skills help move the body from one place to the other, as in walking, running, jumping, leaping, and galloping. The non-motor skills do not require movement, but body domain, such as jumping, spinning, and static balancing. The handling skills are used to project or receive objects, such as throwing, wiping, kicking, rebounding" (Andrade. 2016, p. 2).

It is known that the basic movement patterns are a fundamental factor in the early childhood, when the children's motor skills can be identified through documentary intervention. Observation can be used to specify properties, characteristics, and the profiles of children and objects. In other words, the idea is to gather information independently or collectively, on the concepts or variables referred to. Some activities related to the items conducted, which will help know the basic patterns of movements, are facilitated. Also, the children will become familiar with crawling, dragging, marching, gamboling, running, muscle definition, and posture control, to conduct systematic reviews associated with motor skills in the early ages. Then it describes and

identifies children's defects and complications at every stage of development, which according to previous reviews, must be incorporated to the toddlers' motor skills, as the basis in their relation to their physical activity, considering how good or bad skills may influence their growth.

Overall, there is an absence of practical actions to develop motor skills in children; for instance, "The human needs after birth include going from one place to another; humans are born with a need to move, change position, travelling, as it also contributes to greater survival possibilities" Garcés (2016, p.3).

According to Renzi (2009, p. 3) "It comprises decisions taken by the children in terms of the intentionality of motor actions that will be used to respond to a situation or problem, or an objective, which are closely related to the type of motor interaction established among them". Through imitation, children can get a better perception of the movements required to perform a particular activity.

Moreover, Garófano & Guirado (2017) said that,

> Motricity is not only important as it permits students' motor development, but also because through it, infants can express and communicate their emotions, and acquire the corresponding knowledge, being movement one of the determining factors of learning as a motivating agent that can stimulate children to action, which takes a relevant place in their everyday life. (p. 101)

Finally, Bernate, *et al.* (2019) mentioned the importance of providing integrated education to children since their early stages, strengthening social skills through exercise and collaborative games to enhance physical education in values. Hence, this paper aims to conduct a systemic bibliographic review consisting of analyzing and systematizing the standpoints of different academic referents in the area of Physical Education in motor development processes in early stages, and how they contribute to integrated learning areas transversally. Likewise, this study looks to create a study referent for Physical Education students and teachers in the higher and general education to provide a theoretical referenced overview in terms of pedagogic strategies in this specific area of education and motor education.

MATERIALS AND METHODS

This study consists of a systematic review that studies and evaluates research on didactic strategies used in Physical Education to teach motor skills to infants. The PRISM method and the practical guide of systematic reviews with or without meta-analysis were used in this study.

Eligibility criteria

The criteria for selection in this review were, a) whole papers; b) published between 2007 and 2020; c) in English and Spanish; d) including control and experimental groups; e) with pre-test and post-test actions. The papers were included upon checking their

compliance with the different eligibility criteria shown. Other sources were included as well (analysis of paper references).

Information sources

The search for articles was conducted in different databases (Google Scholar) between 2012 and February 2020. Several search groups were established in referenced journals and theses. 1) Journal Ciencias de la Actividad Física UCM. N° 17(2), 19-28, 2016., 2) Revista Electronica de Educación Física, 3) The Jaén University, Facultad de Humanities and Education Sciences, 4) national and foreign universities in the first term of 2014, 5) Universitat de Vic- Central de Catalunya.

Selection of studies and data mining

Upon the search, the title and abstract of each paper was analyzed to find more relevant data, and discard the studies that failed to meet the inclusion criteria. Then, six articles were selected, which provided information related to the didactic strategies for motor skills, particularly motor skills, didactic strategies, and motor development.

Evaluation

Standard Qualsys evaluation was used in the case of quantitative analysis (Kmet *et al.*, 2021). The search comprised 14 criteria that were associated with research facts, the methodology, data analysis, the results, and the conclusions. Each analysis scored 2 (acceptable), 1 (acceptable skills), 0 (not accepted), and NA (not acceptable). The results were achieved according to the formula [(satisfactory number x 2) + (partially satisfactory x 1)/28 (not applicable x 2)]. The results were displayed in percentages, between 0 and 100%.

RESULTS AND DISCUSSION

From the initial search, a total of 40 papers were collected and analyzed, four of them were written in English, 18 international studies, 14 from Latin America, and 4 national research papers, compiling 40 scientific papers referring to the motor skills in infants. Then the papers written in English were discarded. A number of 14 papers were excluded, 16 were not accepted because they were systematic reviews or bibliographic reviews. Upon the analysis, six papers were included in the systematic review.

Quality of the research

The analysis made by the specialists concluded with a conservative cut off (> 0.75). The overall results were assigned by the first observer, and varied between 0.75 and 0.89; the Qualisys results from the second observer were 0.78-0.89 (Table 1).

Table 1. - *Quality of the research*

Studies	Observer No. 1	Observer No. 2
Rondón *et al.* (2018)	0.78	0.78
Peña (2015)	0.78	0.78
Jiménez *et al.* (2013)	0.75	0.78
Madrona *et al.* (2008)	0.75	0.78
Rodríguez (2020)	0.75	0.78
Cantor (2015)	0.86	0.89

Research description

The main analyses and results are shown in Tables 2, 3, 4 and 5).

Table 2. - *Main research analyses and results*

Studies	Country	N (gender) N (control group and experimental group)	Age and educational level/context	Methodology
Rondón *et al.* (2015)	Cuba	Children Not specified	2-6 Preschool education	Systematic review
Peña (2015)	Colombia	Children Not specified	4-8 Elementary education	Qualitative intervention
Jiménez *et al.* (2013)	Costa Rica	Youngsters Not specified	10-12 Elementary education	Quantitative intervention
Madrona *et al.* (2008)	Spain	Pre-adolescents	12-14 Cadette education	Qualitative intervention
Rodríguez (2020)	Spain	Children Not specified	2-6 Benjamin education	Systematic review
Cantor (2015)	Colombia	Children Not specified	6-7 Elementary education	Quantitative intervention

Table 3. - *Main research analyses and results*

Studies	Instruments	Analysis
Rondón *et al.* (2015)	Theoretical and empirical methods were used.	A novel proposal was made; it can be used in other contexts as well, including other organizational forms at this educational level. It includes teaching aids available to all the agents and agencies in charge of integrated education in the early infancy.
Peña (2015)	The macro curriculum, meso curriculum, and	The theoretical rational validates quite a

	micro curriculum were presented, in keeping with the theoretical statements of Chapter 2, which will help articulate theory and practice, and to emphasize on their reconstruction, based on the context needs. It permits to generating accurate and applied formats during the implementation, which is necessary for the evaluation of coherent processes to determine the results of this research.	few aspects of the project, and it elucidates several concepts of the project, such as basic patterns, movement, early infancy, multidimensionality, and physical education, which confer sense to the project.
Jiménez *et al.* (2013)	The validity of a content is accomplished by means of validity logics. It is based on expert opinion (n = 11). This process is complemented with the calculation of a content index that provides validity. It is equal to 0.99.	Reliability was estimated through the intra-class reliability coefficient to evaluate consistency of trials (R = .918), and between observers (R = .861), being the test applied to 162 people aged 7-27 (M=14.16±5.28).
Madrona *et al.* (2008)	This research will focus on explaining the necessary presence of physical education, and will provide an intervention design in practice, during this educational stage.	Therefore, this paper compiles concepts and assumptions in terms of motor development, motor contents, body expression, methodological standpoint, and motor games and motricity program in infant education.
Rodríguez (2020)	The case study tends to a joint use of different methodologies. The diary and interview, observation, and document analysis are the most commonly used methods to facilitate comprehensive analysis.	The environment-based experience was assessed through parameters using an analytical-descriptive perspective, using the case study methodology and other gathering techniques and tools, and information analysis.
Cantor (2015)	Diagnostic test.	The main goal is to determine the state of the art in relation of motor skills in girls and boys, which was evaluated in accordance with the goals presented.

As shown in Tables 2 and 3, six studies tackled the didactic strategies for motor skill development in education. The countries with the most studies are Spain Madrona *et al*. (2008) and Rodríguez *et al.* (2020), who conducted a similar study in Costa Rica, another in Cuba, and the other two in Colombia (Peña, 2015 and Cantor, 2015). Most studies included an experimental group, and focused on the didactic strategies for the development of motor skills. The interventions lasted between 1.7 and 32 hours.

The instruments used were four studies that articulated the theoretical and empirical methods (Peña, 2015), whereas Madrona (2020) used the diagnostic test for data collection. Moreover, a protocol was set up for the different experimental groups, which used a proposal that validates projects for elucidating theoretical concepts, such as early infancy, basic movement patterns, and physical education. It includes more concepts Cantor (2015).

Table 4. - *Main research analyses and results*

Studies	Research aim	Control group
Rondón *et al.* (2015)	The movement game proposal focuses on children as the center of the educational process. It aims to contribute to the development of skills jumping and climbing.	The children will be scattered, wearing bracelets in different colors. The little frogs are strolling. In this exercise, the children will move like frogs, jumping to the hoop.
Peña (2015)	To stimulate the body dimension of children, considering the different movement possibilities through the basic movement patterns.	No educational influence was used in the control group.
Jiménez *et al.* (2013)	To describe the process of building an instrument, to get its validity and reliability to assess the performance of ten basic movement patterns.	The participants (all underage) were asked to sign a written consent statement, represented by their parents.
Madrona *et al.* (2008)	To justify why physical education is fundamental to develop the motor skills in children.	No educational influence was used in the control group.
Rodríguez (2020)	The goal is to implement and broaden the knowledge gathered through the active methodologies of infant education. It also focuses on how they favor physical education practice.	No educational influence was used in the control group.
Cantor (2015)	To emphasize on the effects of the didactic proposal based on the pedagogical games and the development of motor skills in children.	Traditional methodology

Table 5. - *Main research analyses and results*

Studies	Experimental group	Main results
Rondón *et al.* (2015)	In the original games, the teacher may design alternatives with the objective of the game (main action), or create some new, considering the characteristics of the children. They	A novel proposal was made; it can be used in other contexts as well, including other organizational forms at this educational level. It includes teaching aids available to all the agents

	can be made by changing the original positions.	and agencies in charge of integrated education in the early infancy.
Peña (2015)	The teacher in charge will conduct self-assessment of the process, particularly of the project associated with the pedagogic and didactic planning.	Early infancy is a critical life cycle. Hence, this labor must provide the greatest number of experiences gradually.
Jiménez *et al.* (2013)	In this study, 11 experts collaborated, all of them university teachers (national and foreign), all experts in human movements. Each participated in more than a phase of the validation process.	The results consisted in a valid and reliable instrument for performance assessment of ten basic patterns of movements during a more advanced stage.
Madrona *et al.* (2008)	In this subject and stage, the issues must be addressed, such as excessive sedentary practices or child obesity. Therefore, teachers should be constantly gathering information.	The largest commitment of infant education is making possible that children start their critical path with better conditions, having better basic capacities and a broad reservoir of motor experiences that help them learn more under satisfactory conditions.
Rodríguez (2020)	The case study tends to a joint use of different methodologies. The diary and interview, observation, and document analysis are the most commonly used methods to facilitate comprehensive analysis, and understanding of the experimental techniques in the experimental population.	The results show that this methodology requires a set of continuous movement by students, to access to several proposals and conduct them. Hence, they can be considered as favoring physical activity.
Cantor (2015)	The Diagnostic test protocol includes a table for each skill that explains every item to be considered to assess the children.	Positive changes were observed in terms of practical settings in the children's lives, such as the social setting (communication, family environment, social-affective environment, self-integration, and integration to others); the psychological setting (self-esteem, confidence, knowledge of themselves, and the construction of personality); and the academic setting (greater cognitive development, as to reading, writing, logics, and inter-personal interactions).

The search conducted on the relevance of child motor development revealed the main factors of motor development. Accordingly, motricity is a critical aspect in the school curriculum and in extracurricular activities. Moreover, parents and teachers assure that the Physical Education class is fundamental and ideal for motor and psychological development, including a high level of enhanced determining factors in favor of child education. Therefore, Cenizo *et al.* (2016) recommended that Physical Education is understood as the engine of human integrated development, in which children may experience body recognition, the scenario, and the manner in which they act with social peers. It can also strengthen memory, social relations, attitudes, and emotions. Furthermore, its role in writing and reading is essential, including the mood (Bernate *et al.,* 2020).

Obviously, most studies are done in the initial stages of education, in which motor games are one a source of development of infant psycho-motricity. It may be explained largely because a child's motor and cognitive capacities are more efficiently developed through games. Playing and learning are two indistinctive aspects, since games pose challenges that lead to open learning (Arufe, 2019; Contell, *et al.,* 2017).

Likewise, games at early ages can develop and strengthen factors with a positive incidence in thin and thick motricity, incorporating aspects like basic movement patterns, coordinating capacities, and conditional capacities (Arufe, 2019).

These factors help in this field of study; motor participation and psycho-motor assessment by panels of experts have been largely required in infant education facilities, particularly by the teachers of these centers (Urrea *et al.,* 2018; Gómez, 2017).

Moreover, González (2018) theorized that motor skills in early education look to enhance the motor patterns through objectives set by the teachers, with a practical perspective to improve behavior at early ages.

Consequently, motor skills are components to be enhanced, particularly the cognitive, sensorial, and socio-affective sides (Alonso *et al.* 2017), who referred to a mentally disabled person as a being one who has lost the capacity of having a fixed and absolute trait with a social and organic origin (Bernate and Tarazona, 2021).

Finally, teachers are not the only actors, as families should play a fundamental role. It must be a complementary mechanism so that the children find support and advice on how to improve every motor work session. It means helping the children emotionally, with values, norms, and discipline, providing the proper spaces to explore and develop recognition by means of games. Parents provide this type of teaching since the pre-born stage, with little movement processes. Hence, children can have all the tools needed from the family and school for motor development, so that they can prevent affective, motor, participatory, or cognitive problems, according to authors who support the importance of motor development in early ages, and its social factors (Rius & Torrebadella, 2019).

CONCLUSIONS

Motricity is evidenced in instruments that permit the easiness through which children start demonstrating the development of their motor skills, which must be practiced in every space. Hence, the intervention of teachers and family to help with development, is essential. They provide the tools and support so that the children can have a higher performance, in terms of motricity, in every setting. The objective is to enhance and stimulate the relevance of motricity in early stages, and their connection to the school and social areas.

Games are essential for the biological evolution of children; besides playing a significant role in physical and psychological development of children, they are an excellent teaching aid for a comprehensive and complex education.

Lastly, motricity is not only movements, but a set of related processes within a person; the muscle, bone, nervous, lymphatic, and digestive systems are interrelated. Hence, every system of the body contributes to the development of actions, such as in thick motricity, when a person not only moves, but also analyzes, thinks, decide, and performs, using a set of components that may change that rationale as part of a disability, an emotion, a feeling, or an objective. Accordingly, people can develop movements differently, more or less effectively, so it offers the physical and cognitive tools to provide development as humans with a feeling of success, and a motivation to improve and optimize the motor capacities continuously.

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