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Clumsiness and Motor Competence in Physical Education and Sport Pedagogy

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Abstract

One of the main objectives of physical education and sport (PES) pedagogy in schools is to develop motor competence in children. While many schoolchildren practice sports, there is a group of children that does not receive the educational opportunities to be competent. These children show low motor competence and poor motor coordination. International agencies have called this condition as developmental coordination disorders (DCD) and its definition in short is “poor motor performance in daily activities that is not consistent with the child’s age and intelligence, and is not due to medical condition.” Physical education and sport teachers are the first interventionist with these children. They have the first opportunity of providing primary care to these children. In this chapter, motor coordination problems in school, its prevalence, how these children learn, how physical education and sport teachers can detect them, and why physical education and sport pedagogy must be concerned with this problem, will be analyzed.

Keywords: low motor coordination, motor learning difficulties, teaching, education, schoolchildren

1. Introduction

Children and youth receive numerous physical health benefits from practicing physical education and sport (PES) in school, including better fitness and cardiovascular function, better metabolic function and health, and psychosocial benefits. Despite these benefits, many children continually fail to meet PES recommendations. Physical education should help all children acquire the basic movement foundation needed to access a wide range of physical activities across their lifespan, and without this foundation, children will find it difficult to choose an active way of life [1].

Physical education teachers describe children who look awkward as clumsy, poorly coordinated, or low-skilled. These children have difficulties acquiring and performing basic motor skills such as running, jumping, catching, or throwing. Most physical education classes present children with these problems, and many of them have learned that they will never improve this condition by practice, effort, or instructions [2]. Clumsy children often abdicate responsibility of their performance with “I can’t” statements becoming increasingly frequent [3].

In the last few decades, the research related to children’s motor clumsiness and their effects on development have increased [4–8], to the extent that this problem has been included in the Statistical Manual and Diagnostic of Mental Problems, DSM-5 [9]. One of the paradoxes of this problem is that children, who have it, do not present a disease or a medically diagnosed difficulty as the cause of it [10, 11] although there are efforts to discover the neurological and brain’s connection [6]. They are children who present difficulties in learning motor skills like those that are part of the programs of physical education and sport and show an inefficient and asynchronous motor behavior when they carry out motor tasks, which are usually done by the rest of the people without problems, both at work and leisure [11].

Regarding the prevalence of this condition, and taking into account the existing problems of its identification and use of different measuring instruments, the estimate varies between 5% and 18% in children aged between 4 and 11 years with more boys than girls [6, 7, 10, 11], although the gender differences are still controversial and their effect on adulthood persists. By the time that these children reach adulthood, they may no longer have the desire to participate in physical and healthy activities, and this condition affects their lifestyle and healthy habits [10–14].

There are still controversial aspects surrounding the identification of these children and the ability of different professionals to identify them [15]. This controversy is reflected in the different results of different studies around the world and the different tools that researchers use. This difficulty causes inactive lifestyles, because these children do not develop the motor skills necessary for participation in physical activities and sports, as well as in professional activities that claim the use of the body and movement coordination. All this may affect their social interactions and their health and physical vitality [14]. This physical vitality is clearly diminished and may present risk factors associated with the development of cardiovascular diseases in adulthood [13–15]. The problem is that many children will never acquire the skill level necessary to advance to a higher level of motor competence, and they will be children with a deficit of practice and without motor skill experience, manifesting delays in fundamental motor skill development.

2. Method

There are a lot of research and information about developmental coordination disorders in therapeutic contexts; however, this body of research is scarce in physical education. The review of available research included here promotes an understanding of the subject area and the criticisms that have been made on the topic with special attention given to physical education and sport pedagogy [18]. The purpose of this chapter was to describe the behaviors of clumsy children in physical education and sport classes, how they learn motor skills, and the role of physical education and sport pedagogy in their motor competence. Three areas of

literature were analyzed to allow a better understanding of this problem: (1) literature about the concept of clumsiness, low-skilled children, or developmental coordination disorders; (2) literature dealing with the identification of the low-skilled children in physical education and sport classes; and (3) literature reporting how clumsy children learn motor skills and the role of physical education and sport programs in increasing their motor competence.

3. Clumsy children and physical education and sport classes

Currently there is some concern for clumsy children in physical education and sport classes. Many times, teachers consider that children are clumsy when they are less able in a single or a group of motor tasks, simply based on their low performance in comparison with peers of the same age. These children can experience continued failure in classes, playground, and physical education activities, and it is probable that they manifest a deficit in movement understanding, organization, and control too. There are many terms that physicians, educators, and therapists have been used to characterize these children until arriving at the agreed term of *developmental coordination disorders* (DCD). Terms such as developmental dyspraxia, perceptual-motor impairment, perceptual-motor dysfunction, minimal brain dysfunction, motor development retardation, motor clumsiness, motor coordination problems, or awkward child syndrome have been employed in the scientific and pedagogical literature. Physical education teachers have known them as low-skilled students or simply as clumsy children.

The American Psychiatric Association [9] in its Statistical Manual and Diagnostic of Mental Problems, DSM-5, has called it as developmental coordination disorders (DCD) to which they ascribe the following characteristics:

- Problems with the organization of the movement and its spatial-temporal structure.
- Qualitative differences in their movements compared to those made by their peers.
- The presence of other associated problems that affect their functioning in school life or in their daily activities.

Some physical education researchers [16, 17] define clumsy children as those individuals who have motor learning difficulties and display asynchronous and inefficient motor behavior when attempting to carry out motor tasks that they would commonly be expected to accomplish under reasonable circumstances. Others [19] highlight the cultural component of this clumsiness and consider that these children do not perform culturally normative motor skills with acceptable proficiency. It is considered that children are clumsy when they show real difficulties to coordinate the movements that affect their school life both in the classroom and especially in their activities in the gymnasium or the playground. It is necessary to emphasize the danger of labeling a schoolboy as awkward, as well as the etiquette that it is necessary to show parents who wish to know their opinion about these movement problems that they observe in their children [20].

An idea must be clear; in all physical education classes, there are children who show different degrees of movement difficulties, and the question is to know to what extent they can be palliated and what PE teachers can do.

But who are these children? Which are their main characteristics? How do their problems manifest in physical education classes? An analysis of the different studies carried out on these children shows that globally they possess at least four global characteristics:

- They have a psychophysical integrity that makes them normal for all purposes, hence the difficulty of establishing the causes of such difficulties.
- They have difficulties in carrying out and learning the motor skills of the physical education program.
- They show a delay in fundamental motor skills.
- Its condition does not have to be a global awkwardness, but rather shows a great heterogeneity and specificity.

Their movements in the gym are uncoordinated and ineffective, not having the resources, or the competence, necessary to respond to the requirements of the physical education or sport learning classes. Their fundamental motor skills tend to be behind the rest of his peers, being aware of this situation, which further aggravates his condition. Physical education classes are a source of tension and anxiety for him because of the difficulty in being able to carry out the motor tasks as proposed by the teacher or when he must play with their peers. In the gym, they feel disoriented; they do not know when they should act, and when they do, it is too soon or too late, and their peers scold them, when they do not laugh at him. This situation can cause them to end up hating the subject [2, 3].

PES teachers need to have a more concrete idea of what really characterizes a clumsy child because his difficulties could be shown in some tasks, but not in others. Thus, some schoolchildren may find manual tasks very difficult, while for others, difficulties arise when they must move globally to meet the requirements of the class. While for some it is difficult to perform ball games, for others it is to maintain balance and control in space. This mosaic of difficulties makes it difficult to establish a single profile [21].

Different authors [21, 22] emphasized the existence of a series of characteristics among the students with these problems of coordination:

1. These children show a high variability from one trial to another when they carry out motor tasks.
2. They continue to act in the same way even if the situation no longer requires it.
3. Sometimes they are unable to separate their performances from those made by a model, becoming its mirror.
4. They seem to manifest problems of integration of the different parts of the body, and when they are going to jump, and need the coordinated action of the two arms to make the jump, one of the arms acts while the other remains rigid and does not collaborate in the action.
5. They can have problems of dynamic balance, instability, and tremor, especially in those tasks that demand a certain control and precision in the performance.

6. They fall easily after jumping, throwing, or kicking a ball.
7. When they move, incorporate strange movements that give an awkward appearance to their performances.
8. They are not able to follow rhythms especially when the rhythm is imposed from the outside.
9. They show lack of control of the strength when they pass too strong the ball that can hit his partner, which no longer will choose them as a couple in the next class.
10. They can have problems to plan their actions.

Clumsy children problems, far from having a defined profile, can be manifested differently and before different tasks and situations. This makes the identification as well as the establishment of its possible causes complex, since while some children may present problems of a kinesthetic or visual nature [23], for others the problems may lie in the slowness of processing, the difficulties to retain visual patterns in short periods of time or in their low knowledge of the actions they have to perform [6, 7].

Children progress through the various stages of motor development, and clumsy children tend to lag their peer's motor competence and learning sport skills. These children have not reached the level of desirable motor development to be able to practice with competence in physical education classes. His fundamental skills are in a stage very elementary for his age. Its functionality is clearly delayed with respect to the rest of his class. This difficulty makes them constantly watched and criticized by their peers and, in many cases, by their teachers and parents who think that their problem is due to their lack of interest in the subject, because they do not pay due attention to what must be performed. But sometimes, the teacher is presented with the difficulty of not being able to easily identify the possible causes of this condition, accepting that the child will grow out of it and implementing a *wait and see* policy.

One of the serious issues that emerge from the lack of knowledge and training of physical educators is that this group of at risk children is left without the educational support that they need [24]. A good assessment would be essential and more information and training would be desirable.

4. How to detect these children in PE and sport classes

Knowing what children can do is basic if teachers who want to evaluate their motor competence and if they develop within the margins of the desirable for their age. Knowing what children can do helps the teacher to know:

- The current situation of children and their evolution over time.
- What affects motor development of children and what influence their motor coordination.
- What to do and get informative feedback of the effect of the pedagogical interventions with these children.

Teachers have difficulty with the identification of clumsy children. The limited emphasis placed on motor development in their graduate training contributes to this limited knowledge of motor skill learning difficulties [24].

There are many tools that physical education professionals have developed to know how their students move and develop in the classes [25], but many of them do not have the qualities of measurement that offer the security to the professional that with their employment they will obtain valid and reliable information. Therefore, it is necessary, in a systematic, simple, and useful way, to determine if the process of developing motor competence is being carried out reasonably and within healthy margins.

There are different tools and instruments (batteries, checklists, and tests) that permit confirmation of a teacher's intuitions. However, it is important to know what to evaluate and what kind of instruments is more appropriate. There are different assessment tools available [26]. On the one hand, there are tests or batteries developed to compare the performance of schoolchildren with respect to previously established norms in a set of physical and motor skills [27]. On the other hand, there is another set of tests or batteries based on the existence of a series of performance criteria based on the research and the opinion of the experts, which establishes which are the most relevant morphological characteristics of the tasks evaluated in every age group. In this case, there are no norms but levels of performance and a series of criteria.

Each type of instrument demands a competence of the teachers. They must know in depth how to present and organize the application of the test or battery, apply it, and interpret the individual results with respect to the norm. In the second type of instruments, an adequate knowledge of the child motor development and about the characteristics of the fundamental motor skills is demanded.

Among these instruments, we would highlight batteries and tests such as Body Coordination Test for Children (KKTK) [28], the Movement ABC-2 Battery [29], Bruininks-Oseretsky-2 of Motor Performance [30], or the MAND motor test [31]. These comprehensive tests use product and/or process forms of assessment. They require more time for administration and more skill in the movement domain for a competent interpretation, something that many PE teachers do not have.

In this sense, motor tests like the stay in step gross motor test [32] or the GRAMI-2 Motor Test [33] are short motor tests developed with the objective of a quick screening of children and being able to detect those children with motor coordination problems in physical education and provide information to teachers for the adaptation of programs and intervention. These tests have a group of tasks with a great power of clumsiness prediction like hopping, bouncing, or lateral jumps. It has the advantage of being easily administered by the PE teacher in the class schedule.

Some of these batteries or motor tests are accompanied by observation sheets or motor checklists that can be used by teachers. This is the case of the observation checklist accompanying the MABC-2 battery [29, 34], scales for the assessing the motor performance [35], the Coordination Disorders Questionnaire (DCDQ) [36], ECEF Motor Competence Scale [37], or the Fine Motor Competence Questionnaire [27]. There are also different scales, inventories, or questionnaires to be used by parents to detect coordination problems in childhood [38].

5. How clumsy children learn motor and sport skills

Unless poorly coordinated children have been previously referred by their parents and consequently identified by a medical practitioner or therapist, the first interventionist with these children is the PES teachers. They have the first opportunity of providing primary care to these children, but unfortunately, they do not offer adequate help probably because they do not have the knowledge and skills necessary to teach clumsy children [39].

In the last decade, there have been numerous efforts to develop intervention procedures to alleviate or solve the effects of coordination problems among school-aged children. These procedures are highly related to the training and experiences of their authors; hence they can be classified differently. We could say that they move between two poles, between those focused on the processes involved that need to be improved or remedied, and those focused in developing specific functional skills so that children can interact in a competent way in the social and cultural context in which they grow and develop [24, 40]. When teachers instruct clumsy children, they need to answer several questions over what to teach and how to teach, which teaching style is the most appropriate for clumsy children or which are the true needs of these children [41]. These questions demand the teachers to know in depth the children's motor development [19].

Professionals and researchers call for the development of intervention programs that help these students overcome their coordination problems [16, 17, 41, 42]. School-based physical education programs are of a more general nature than clinical interventions. It is common that in studies in which intervention programs have been developed with clumsy children, too little attention was paid to the teacher's competence to teach and develop the tasks under study.

Sport pedagogues have usually addressed the teaching of physical education and sport programs with at least three instructive procedures, namely (1) the most direct procedure, (2) a procedure in which they have allowed the participation of the students in different decisions, and (3) an approach explicitly centered on the children [43].

One of the intervention models that has received special attention for its favorable results and which has great potential in PES classes is the so-called task-centered approach [44, 45]. In this approach, children perform in a specific way those functional motor tasks that the teacher considers more important, since they allow the learning of more complex skills and permit interactions with other members of the class, but also it has its disadvantages, since the child many times does not actively participate in any of the instructional decisions.

It is necessary to consider several aspects when choosing a task-centered approach in the teaching of specific tasks [46] and that supposes organizing everything so that:

1. The child receives a clear idea of what is to be learned.
2. The child receives key information about the movement.
3. The child receives specific feedback from his actions.
4. The child receives an abundant practice for the learning of these skills.
5. The child perceives success in 80% of the occasions.

This procedure has nothing to do with a teaching by command style or a militarized approach of teaching, in which all is done in the same way and at the same time. This procedure does not avoid the development of an atmosphere of achievement, effort, and personal progress [47]. Task-specific interventions provide a practical option to deal with the heterogeneity of these problems.

There are other proposals in which students are asked to explore their perceptual and motor space of work, so that they try to perceive affordances and discover the procedure of action that better solves the problem. These are procedures that some scholars have called nonlinear pedagogy and others ecological task analysis. In these approaches value is given to discovery and exploration, and the teacher does not need to use so abundantly the explanations and establish the contexts of practice that favor these processes [48, 49]. Teaching clumsy children in physical education must adapt to the individuals' needs of these children. Teaching those specific cultural skills necessary for being involved in the activities of the class needs to concentrate in the movement skill and practice until they can execute them with sufficient proficiency.

Many pedagogues have proposed different teaching methods depending on the nature of the task and the peculiarities of the children [44]. It is important to remember that many clumsy children do not excel at almost anything and that they may have certain desires that fit properly which could be a source of proposals for the teacher.

To the schoolboy who would like to play ball with his teammates, he demands that we teach him to catch, pass, and throw, specific skills that can constitute the program of work of a specific period. Performing a developmental task analysis of fundamental skills may be a good decision to work with these students. With this type of analysis, the teacher can develop a wide range of tasks and learning experiences, as well as being able to use it as an individualized evaluation tool, since it allows the elaboration of a performance profile with interesting nuances of complexity for the follow-up of the progress [40]. Ecological task analysis (ETA) [49] has established different classifications of motor tasks from a functional point of view, i.e., according to their functional objective, establishing four categories: locomotion, manipulation of objects, projection and trapping of objects, and maintenance and orientation of the posture.

The pedagogical research in which this perspective has been adopted in working with awkward children is very scarce. For its proponents, there are four steps that should be taken [49]:

1. *Establish objectives by structuring the physical and social context.* This will be the first decision to be made, which involves asking questions such as what do my students need to master? What kind of skills should they use? How should I structure the environment? What modifications should be made to reach the goal? How should I present skills to help them to understand it and feel motivated to reach them? Undoubtedly the interests and desires of children are a great clue to establish the objectives. This introduces emotional variables in the process, and this emotional dimension has a significant influence in clumsy children when they are learning motor skills.
2. *Allow the student to look for possible solutions to the problems raised, and take advantage of these solutions to consolidate these patterns of movement and move toward more complex ones.* This search can give the teacher a high number of keys to understand the motor dynamism of

these children and their difficulties. It is likely that new synergies and coordination will emerge as a solution to the proposed task and that they will collide with what is expected; it is interesting to contemplate them and assess their functionality in these children.

3. *Manipulate the constraints related to the subject, environment, and task.* The teacher can handle the most relevant variables of the learning situation so that children can exercise its possibilities of action. It means, on the one hand, to vary certain dimensions of the task, the context, and even the child and, on the other, to assume that there is not a single correct solution to achieve the established objective but that there are different possibilities and that all have their potential to be exploited in the dynamics of each session. This is of great interest for clumsy children who feel cornered by the idea that there is only one way to carry out the tasks.
4. *Provide appropriate instructional support.* If in previous steps the concern was to establish the most favorable conditions of practice, this step refers to the need to offer the necessary supports to children. It is very likely that they will have difficulty understanding tasks in the first trials and that it will be necessary to offer them support and keep going. It is necessary to find a balance between excessive direction that limits and a lack of direction that causes insecurity and loss of motivation.

Teachers know that until they have mastered a task, they go through a series of stages in which motivation, information, and feedback as well as attention progress in a variable way [44, 50]. These children show limitations in their ability to attend to the relevant aspects of the tasks. Managing information and moving simultaneously are very problematic for them; hence teachers should select the information to be transmitted and not to exceed the attentional capacity of these students. These children can learn to attend and to listen properly and to look in the right direction; hence teachers must know what information will be needed to help direct their attention to the area of greatest information relevance [51].

Probably one of the concerns of teachers is to ensure that students have a high willingness to learn and practice. The students bring with them a whole series of expectations about what will be developed in the classroom, the teaching context, the material, the teacher, and the tasks themselves, and in the case of clumsy children, these previous expectations often lead them to not want to go to class because they hope they will fail again, their classmates will laugh, and their teachers will not give them the necessary attention. They have always been adjusting to the level of the class, a level that they are not able to achieve, which has undermined their confidence in a very remarkable way. Teachers must be sensitive to the needs of these students and do so in a positive way, as they are always poorly viewed in class and are likely to begin to show signs of learned helplessness, reacting aggressively and with inappropriate behaviors [3, 40].

Clumsy children in physical education and sport classes do not perceive as meaningful the tasks they practice, and therefore, they are not motivated. It is necessary to consider the interests and needs of these students. To choose key fundamental motor skills that allow them to play and participate with their peers in other activities is a way of giving meaning to the practice. The motor learning process in physical education and sport classes entails putting into action all sensory-perceptual channels of children, which in the case of clumsy children could be the origin of their difficulties.

Adopting a multisensory approach is very appropriate for the child to relate what he sees with what he listens to and with what he feels when mobilized. With practice and patience, these children learn to feel the movement; however, when it is decided to mobilize kinesthetically to the students, it is necessary to consider not only the spatial reference and its trajectory in the correct orientation; the child's participation in the mobilization is very important, since guiding in excess does not favor motor retention [52].

But last, *what kind of practice will be most appropriate for these students? How much practice will they need to improve their motor competence? Which organization of practice will be the most appropriate?*

It is common in physical education and sport classes to practice the tasks in a global way, as they are, focusing the teacher overall and less on the details of it, but for many clumsy children, many of these tasks presented in class are very difficult to grasp globally; they have problems remembering the parts that compose them, so it is appropriate to think of more analytical procedures and its combinations.

Procedures like part-whole learning can be effective with different tasks and different children. For some specialists, the progressive part learning procedure has proved to be very effective with children with clumsiness since it progressively allows the components of a motor task to be mastered and combined to show the skill as it is globally [46, 53, 54]. Children with clumsiness present peculiarities in their way of conceiving the organization of the task and of representing it, which makes it necessary to switch constantly back and forth between the components of the skill [55, 56].

An important aspect in the work with these students is to assume that their physical condition is far below that of the rest of the classmates. They have a deficit of activity, which makes them vulnerable to fatigue [57]. Clumsy children showed lower explosive power, muscle strength and endurance, and cardiorespiratory fitness. Overall, these children had lower levels of physical fitness, even with normal body mass index [58]. These children need to repeat tasks that they are learning many times, but this consumes energy that in many cases they do not have, which leads them to be in a situation that even their safety can be compromised.

Teachers should be aware of this situation, hence the importance of providing rest periods, which can also avoid boredom and deterioration of their performance. It is important to consider that the same tasks can be done in different ways [59], suggesting that variability of practice can be a good resource for teachers. This procedure can help children to learn and being motivated but, sometimes to begin a class directly with a variable practice approach, can be uncertain to clumsy children who seek to establish a relatively stable motor pattern that gives them confidence [60].

Repeating the same action many times in the same way, to progressively introduce variations of the same task, can be an excellent way to promote the application of what has been learned to a similar situation and to promote the process of transference. Clumsy children while practicing need to be given feedback on improvements and progress they are achieving, as well as how to overcome the difficulties they are encountering. These children have less motor experience, which means that their knowledge is less and that teachers often make the mistake of offering too imprecise or too precise feedback.

The message must be to help these children to understand what they are going to practice. It is also appropriate to remember the difficulties of attention and retention that these children can manifest, which leads them to focus their efforts on what it is not relevant, hence the importance for teachers to analyze tasks before presenting to children [55, 56].

It seems logical to think that the work in large groups does not favor learning for these students; hence individual work or small groups are the best alternative. This work in small groups helps these children to participate in physical education classes, if teachers organize their classes properly and do not leave these decisions to children who will always ignore their more clumsy classmates. Small groups not only allow the child to practice with other peers with different levels of competence but also favor the process of socialization and relationship among them, inciting cooperation and acceptance of other less competent [61–63].

Providing feedback on what is being practiced is an essential aspect of progress [53]. Clumsy children need informational support to progress, but it is not necessary to give supplementary information in each stage because of the danger of making the child dependent on teacher's interventions. It is important for the teacher to show interest in children's learning. One of the most remarkable aspects of the narratives of clumsy adults is that when they were children, teachers did not pay attention to them [12, 13]. Pedagogical research is showing how effective it is to create an atmosphere of work in which children are recognized for their effort and dedication and where teachers offer feedback on good achievements [64] and when their students request them.

6. Why physical education and sport pedagogy must be concerned with this problem

As already indicated in the first sections of this chapter, the first professionals who meet these children in school are the classroom and physical education and sport teacher. The movement difficulties presented by these children represent a great challenge for them when discussing teaching methods that can be used to work to improve their motor skills.

But, why must PE teachers be concerned with this problem? The main objective of physical education in schools is to develop motor competence in all children, not only in skillful children. To be competent it is necessary to begin being incompetent, and PES teachers must provide their children with the tasks and experiences that help them to improve their motor coordination. The identification and teaching of these children are the responsibility of these teachers. If physical education teachers do not care about clumsy children in school, who will?

These children, boys and girls, need more attention and more patience from their teachers. Why? Because they do not follow the same pace of learning than that of their classmates, and because the physical education environment generates feelings of failure in these children [63]. Clumsy children often feel they do not have control over the environment and are unable to prevent motor failure. It is in this situation when they begin to develop what has been called learned helplessness [65, 66]. Teachers need to be aware of these circumstances and establish a pedagogical atmosphere where these children could practice without being

judged by their peers. These will then ensure that their clumsiness can be kept at a minimum and provide them with tasks, motivation, and confidence that permit them to achieve success.

These children need a learning environment that considers the difference, a warmer teaching context where peers can understand that everybody has their own process of learning. They are able to acquire specific motor skills, but they have problems to transfer general aspects from one skill to another [67]. This problem can be solved by a task approach that first selects skills that are nuclear and necessary to learn other skills, to apply to different situations and to permit participation in play and games, and, second, breaks skills down into easier steps and offers multiple opportunities of practice and feedback [68]. Clumsy children need extensive teaching and continual reinforcement. PES teachers have to assume that with these children, it is necessary to reteach fundamental skills (catching, running, landing, throwing, etc.). These children avoid playing and practicing outside classes and have a lack of motor experiences and a deficit of practice [55]. Physical education and sport is for all children regardless of their level of motor competence, and if teachers are aware of clumsy children, their pedagogical strategies can be designed to help them to be more competent and enhance their experiences in class.

7. Concluding remarks

Physical education and sport pedagogy must be more concerned with this problem than it has been until now. It should consider what professionals should do with children with coordination problems in the class. It should investigate what teaching methods are most appropriate and how to achieve a climate of learning and teaching appropriate for these students with these specific needs.

It must be considered how to train teachers so that they are able to direct their eyes not only toward those who are competent but also toward those who have a low motor competence and developmental motor coordination problems. Identification of these children is not an easy task, which is the reason for developing objective assessment tools for PES teachers for early recognition of this “at-risk” group. Quick and simple screening devices like checklists or motor test like GRAMI-2 motor tests are appropriate for PES teachers given the limitations of their training in motor development, the difficulty to identify motor coordination problems, and the time constraints.

If these children are not correctly identified, they are not going to receive the educational opportunities and support to alleviate the effects of their condition. Well-developed physical education and sport programs can contribute to the motor skill learning of poorly coordinated children and alleviate their social problems.

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References

- [1] Bailey R, Armour K, Kirk D, Jess M, Pickup I, Sandford R, BERA Group. The educational benefits claimed for physical education and school sport: An academic review. *Research Papers in Education*. 2009;**24**(1):1-27
- [2] Carlson TB. We hate the gym: Student alienation from physical education. *Journal of Teaching in Physical Education*. 1995;**14**:467-477
- [3] Walling MD, Martinek TJ. Learned helplessness: A case student of a middle school student. *Journal of Teaching in Physical Education*. 1995;**14**:454-466
- [4] Carlson TB. "Now, I Think I Can". The reaction of eight low-skilled students to Sport Education. *The ACHPER Healthy Lifestyles Journal*. 1995;**150**:6-8
- [5] Wall AE, Reid G, Paton J. The syndrome of physical awkwardness. In: Reid G, editor. *Problems in Movement Control*. North Holland: Elsevier Publishers B.V.; 1990. p. 283-315
- [6] Vaivre-Douret L. Developmental coordination disorders: State of art. *Neuropsychologie Clinique*. 2014;**44**:13-23. DOI: 10.1016/j.neucli.2013.10.133
- [7] Visser J. Developmental coordination disorder: A review of research on subtypes and comorbidities. *Human Movement Science*. 2003;**22**:479-493. DOI: 10.1016/j.humov.2003.09.005
- [8] Hyde C, Rigoli S, Piek J. Developmental coordination disorder. In: Rinehart N, Bradshaw J, Enticott P, editors. *Developmental Disorders of the Brain*. New York: Routledge; 2017. Chapter 5
- [9] American Psychiatric Association. *Manual de Diagnóstico y Estadístico de Trastornos Mentales DSM-5*. España: Panamericana; 2014
- [10] Edmonds C. Why teachers need to hear the voice and experience of the child with dyspraxia. *Research in Teacher Education*. 2013;**3**(1):5-10
- [11] Parker HE, Larkin D. Children's co-ordination and developmental movement difficulty. In: Savelsberg G, Davids K, Vander Kamp J, Bennett SI, editors. *Development of Movement Co-ordination in Children* Londres. Routledge; 2003. pp. 107-137

- [12] Ruiz LM, Palomo M, Gomez-Ruano MA, Navia JA. El efecto de los problemas evolutivos de coordinación motriz en las conductas saludables y estilo de vida en la adultez. Research Report. Cátedra Real Madrid: Universidad Europea de Madrid; 2017
- [13] Fitzpatrick DA, Watkinson EJ. The lived experience of physical awkwardness: Adults' retrospective views. *Adapted Physical Activity Quarterly*. 2003;20:279-297
- [14] Cousins M, Smyth MM. Developmental coordination impairments in adulthood. *Human Movement Science*. 2003;22:433-459. DOI: 10.1016/j.humov.2003.09.003
- [15] Cairney J. *Developmental Coordination Disorders and its Consequences*. Toronto: University of Toronto Press; 2015
- [16] Arheim D, Sinclair W. *El niño torpe. Un programa de terapia motriz*. Buenos Aires: Panamericana. 1976
- [17] Revie G, Larkin D. Screening for movement intervention. *The ACHPER National Journal*. 1995;42(1):4-7
- [18] Hart C. *Doing a Literature Review. Releasing the Social Science Research*. London: SAGE; 2007
- [19] Wall AE. Physical awkward children. A motor development perspective. In: Das JP, Mulcahy RF, Wall AE. *Theory and Research in Learning Disabilities*. New York: Springer+ Business Media, LLC; 1980. pp. 253-268
- [20] Henderson S. Motor development and minor handicap. In: Kalverboer A, Hopkins B, Geuze R. *Motor Development in Early and Later Childhood*. Cambridge: Cambridge University Press; 1993. pp. 287-306
- [21] Hoare D. Subtypes of developmental coordination disorder. *Adapted Physical Activity Quarterly*. 1994;11:158-169
- [22] Haubenstricker JL. Motor development in children with learning disabilities. *Journal of Physical Education, Recreation & Dance*. 1982;52(5):41-44
- [23] Gómez M, Ruiz LM, Mata E. Los problemas evolutivos de coordinación en la adolescencia: Análisis de una dificultad oculta. *Revista Internacional de Ciencias del Deporte. Revista Internacional de Ciencias del Deporte*. 2006;3:44-54. DOI: 10.5232/ricyde2006.00303
- [24] Revie G, Larkin D. Looking at movement: Problem with teacher identification of poorly coordinated children. *The ACHPER National Journal*. 1993;40:4-9
- [25] Gärtner H, Hirtz P. On coordinative motor efficiency at school age. In: Haag H, editor. *Physical Education and Evaluation*. Schorndorf: Verlag K. Hofmann; 1979. pp. 198-200
- [26] Burton WA, Miller ED. *Movement Skill Assessment*. Champaign: Human Kinetics; 1998
- [27] Chin-Kai L, Ling-Fu M, Ya Wen Y, Che-Kuo C, Kuan-Hua L. Factor analysis of the contextual fine motor questionnaire in children. *Research in Developmental Disabilities*. 2013;35:512-519. DOI: 10.1016/j.ridd.2013.11.007

- [28] Kiphard EJ, Schilling VF. Körper-koordinations-test für kinder KTK: Manual. Von Fridhelm Schilling. Weinheim: Beltz Test; 1974
- [29] Herdenson SE, Sudgen DA, Barnett S. Movement Assessment Battery for Children-2. Madrid: Pearson; 2010
- [30] Bruininks R, Bruininks B. Bruininks-Oseretsky Test of Motor Proficiency. 2nd ed. Minneapolis, MN: NCS Pearson; 2005
- [31] McCarron LT. McCarron Assessment of Neuromuscular Development. MAND. 3rd ed. McCarron-Dial Systems: Dallas, TX; 2011
- [32] Larkin D, Revie G. Stay in Step: A Gross Screening Test for Children K-2. Authors: Sydney; 1994
- [33] Ruiz LM, Rioja N, Graupera JL, Palomo M, García V. GRAMI-2: Desarrollo de un test para evaluar la coordinación motriz global en la educación primaria. Revista Iberoamericana de Psicología del Ejercicio y el Deporte. 2014;**10**(1):103-111
- [34] Wright HC, Sugden DA, Ng R, Tan J. Identification of children with movement problems in Singapore: Usefulness of the movement ABC checklist. Adapted Physical Activity Quarterly. 1994;**11**:150-157
- [35] Liljestrang P, Jeremy R, Wu IW, Ferreiro DM, Escobar GJ, Newman TB. Use of the motor performance checklist to study motor outcomes in 5-year-olds. Journal of Pediatrics and Child Health. 2009;**45**:368-374
- [36] Wilson BN, Kaplan BJ, Crawford SC, Campbell A, Dewey D. Reliability and validity of a parent questionnaire on childhood motor skills. The American Journal of Occupational Therapy. 2000;**54**(5):484-493
- [37] Ruiz LM, Mendez MA, Graupera JL. Observar la Competencia de los Escolares de 6 a 8 años en Educación Física: La Escala ECEF 6-8. Revista Pedagógica ADAL. 2015;**17**(29):6-12
- [38] Schoemaker MM, Flapper BCT, Reinderes-Messelink HAR, de Kloet A. Validity of the motor observation questionnaire for teachers as a screening instrument for children at risk for developmental coordination disorder. Human Movement Science. 2008;**27**:190-199. DOI: 10.1016/j.humov.2008.02.003
- [39] Miyahara M, Wafer A. Clinical intervention for children with developmental coordination disorder: A multiple case study. Adapted Physical Activity Quarterly. 2004;**21**:281-300
- [40] Ruiz LM. Moverse con dificultad en la escuela. Introducción a los problemas evolutivos de coordinación motriz. Sevilla: Wanceulen; 2005
- [41] Miyahara M. A meta-analysis of intervention studies on children with developmental coordination disorder. Corpus, Psyche et Societas. 1996;**3**(1):11-18
- [42] Sigmundsson H, Pedersen AV, Whiting HTA, Ingvaldsen RP. We can cure your child's clumsiness! A review of intervention methods. Scandinavian Journal of Rehabilitation Medicine. 1998;**30**:101-106

- [43] Mosston M, Asworth S. Teaching Physical Education. First online edition. London: Pearson Education; 2008. http://www.spectrumofteachingstyles.org/pdfs/ebook/Teaching_Physical_Edu_1st_Online_old.pdf
- [44] Larkin D, Hoare D. Out of Step. Coordinating Kid's Movement. Nedlands: The University of Western Australia; 1991
- [45] Revie G, Larkin D. Task-specific intervention with children reduces movement problems. *Adapted Physical Activity Quarterly*. 1993;**10**:29-41
- [46] Rink J. Teaching Physical Education for Learning. 7th ed. New York: McGraw Hill; 2014
- [47] Graham G, Hale H, Ann S, Parker M. Children Moving: A Reflective Approach to Teaching Physical Education. Mountain View, Calif: Mayfield Publishing Company; 1993
- [48] Chow JY, Davids K, Button C, Shuttelworth R, Renshaw I, Araujo D. The role of non-linear pedagogy in physical education. *Review of Educational Research*. 2007;**77**(3):251-278. DOI: 10.3102/003465430305615
- [49] Davis WE, Broadhead GD. Ecological Task Analysis and Movement. Human Kinetics: Champaign; 2007
- [50] Missuna Ch, Mandich A. Integrating motor learning theories in practice. In: Cermak SA, Larkin D, editors. Development Coordination Disorder. Australia: Delmar; 2002. pp. 221-233
- [51] Sudgen DA, Chambers ME. Models of intervention: Towards an eco-developmental approach. In: Sudgen D, Chambers M, editors. Children with Developmental Coordination Disorder. London: Whurr Publishers; 2005. pp. 189-211
- [52] Loftesnes LM, Ingvaldsen RP, Sigmundsson H. Children with developmental coordination disorder: Can underlying perceptual disability be remediated through specific training? *Psychological Reports*. 2017;**120**(2):1-13. DOI: 10.1177/0031512517689972
- [53] Ruiz LM. Deporte y aprendizaje. Procesos de adquisición y desarrollo de habilidades. Madrid: Visor; 2002
- [54] Cratty BJ. Clumsy Child Syndromes: Descriptions, Evaluation, and Remediation. Australia: Harwood Academic Publishers; 1994
- [55] Larkin D, Parker HE. Teaching landing to children with and without developmental coordination disorder. *Pediatric Exercise Science*. 1998;**10**:123-136
- [56] Ghorbani S, Bund A. Throwing skills: Analysis of movement phases in early motor learning. *Perceptual and Motor Skills*. 2017;**124**(2):1-12. DOI: 10.1177/0031512517689972
- [57] Rivilis I, Hay J, Cairney J, Klentrou P, Liu J, Faught BE. Physical activity and fitness in children with developmental coordination disorder: A systematic review. *Research in Developmental Disabilities*. 2011;**32**:894-910
- [58] Hiragai CY, Higassiaraguti PR, Ferracioli RM, Gama DT, Pellegrini M. Physical fitness in children with probable developmental coordination disorder and normal body mass index. *Revista Brasileira Cineantropometria e Desempenho Humano*. 2014;**16**(2):182-190

- [59] Ruiz LM. Competencia Motriz. Elementos para comprender el aprendizaje motor en educación física. Madrid: Gymnos; 1995
- [60] Bonney E, Jelsma D, Ferguson G, Smits-Engelsman B. Variable training does not lead to better motor learning compared to repetitive training in children with and without DCD when exposed to active video games. *Research in Developmental Disabilities*. 2017;**62**:124-136
- [61] Betts M, Underwood GL. The experience of three low motor ability pupils in infant physical education. *The Bulletin of Physical Education*. 1992;**28**(3):45-56
- [62] Whitehall C, Underwood GL. A case study of the behavior of pupils with high and low motor ability in primary school games lessons. *The Bulletin of Physical Education*. 1991;**27**(3):24-33
- [63] Goodway JD, Crowe H, Ward P. Effects of motor skill instruction on fundamental motor skill development. *Adapted Physical Activity Quarterly*. 2003;**20**:298-314
- [64] Chiviakowsky S, Wulf G. Feedback after good trials enhances learning. *Research Quarterly for Exercise and Sport*. 2007;**71**(1):40-47
- [65] Ruiz LM. Aprender a ser incompetente en educación física: Un enfoque psicosocial. *Revista Apunts de Educacion Física y Deporte*. 2000;**60**:20-25
- [66] Whitehead J. Teacher/pupil interaction in PE-the key of success. *The Bulletin of Physical Education*. 1990;**26**(2):27-30
- [67] Keogh JF, Oliver JNA. Clinical study of physically awkward educationally subnormal boys. *The Research Quarterly*. 1968;**39**:301-307
- [68] Martinek T, Crowe PB, Rejeski WJ. *Pygmalion in the Gym: Causes and Effects of Expectations in Teaching and Coaching*. New York: Leisure Press; 1982

