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# Physical Literacy Assessment and Its Potential for Identification and Treatment of Children with Neuro-Developmental Behavioral Intellectual Disorders

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**Abstract** The following commentary proposes that the current identification protocols for identifying children with neuro-developmental behavioral intellectual disorders (NDBIDs) are limited. Increasing prevalence of physical inactivity in children and those diagnosed with NDBIDs creating public health concerns, new methods of identification, and treatment may be warranted. We suggest the diagnostic and treatment protocols for all children (not just those with NDBIDs) may be enhanced by using the concept of physical literacy as a philosophical premise for assessment instrument design and strength-based treatment.

**Keywords** Physical literacy · Screening · Children · Neuro-developmental disorders

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This article is part of the Topical Collection on *Screening*

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## Background

Physical literacy is a concept that is gaining greater acceptance around the world with UNESCO recognizing it as a central tenet in a quality physical education, sport, and physical activity framework [1–2]. According to Whitehead [3], physical literacy can be described as a disposition to capitalize on the human embodied capability, wherein the individual has the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for maintaining purposeful physical pursuits/activities throughout the life course.

Physical literacy is often misinterpreted as the development of fundamental movement skills required for specific sports or physical pursuits [4]. On the contrary, advocates argue for the development of a *bank of diverse movement competencies* [5••] rather than specific fundamental movement skills and link these competencies broadly to participation and inclusion. In other words, having at ones disposal, a range of diverse movement competencies opens up opportunities for engagement and participation beyond organized sport or exercise. This is supported with a recent consensus statement that there is no evidence that children will benefit from early sport specialization in the majority of sports or physical activity and that it may actually be detrimental to their long-term physical and emotional development [6]. Physical literacy also recognizes the flaws in many contemporary movement skill assessment instruments drawn from a “disability” etiology rather than a “capacity” perspective.

According to Almond [4], physical literacy has value as a concept in health because it fosters a fundamental *capacity* that has the potential to enhance the quality of

lives and one without which we could not operate as human beings. Antonovsky [7] described this in his model of health promotion as moving individuals in the direction of positive health and well-being (salutogenesis) rather than negative health (pathogenesis). Much in the same light, Almond [4] argues that physical literacy is an individual's capacity to understand the benefits of regular engagement in *purposeful physical pursuits* rather than physical activity for merely disease prevention.

As recently stated by the Chief Medical Officer of the UK, purposeful physical pursuits could have a significant role to play in promoting the health and well-being of individuals [8]. Participation in a range of purposeful physical pursuits provides the opportunity for individuals to develop a variety of human capabilities. For example, these pursuits can foster appropriate interpersonal skills that require participants to develop cooperative skills such as empathy, reciprocity, and sensitivity. In addition, engagement in purposeful physical pursuits takes place within a context of different social networks in which others can contribute to a person's "growth" and they in turn contribute to the growth of their peers and social contacts.

Children with NDBIDs (such as autism (ASD), developmental coordination disorder (DCD), and attention disorders (ADHD)) often exhibit behavior contrary to what has been described as "engaging in purposeful physical pursuits" [9]. Children with NDBIDs can have lifelong difficulties in communication, social interaction, and restrictive or repetitive interests. They often exhibit an inability to build satisfactory relationships with peers and teachers and demonstrate inappropriate types of behavior or feelings under normal circumstances [10]. Many of these neuro-developmental behavioral disorders are exhibited in children in industrialized countries where physical activity participation levels have already reached historical lows. Figures as high as 15 % of children are described as having learning disabilities, developmental delay, attention deficit hyperactivity disorder, autism, reduced intelligence quotient, and cerebral palsy [10]. In Aboriginal children, the prevalence is often much higher. Although some cases are linked to specific exposures, e.g., fetal alcohol, tobacco smoke, low birth weight, and obstetric complications, in most cases, specific etiology is unknown. Increasingly though, it also recognized that children with NDBIDs show significant delay and/or problems in motor coordination [10]. These "deficits" in motor ability in turn have been linked to a range of secondary outcomes including lower participation in sport, less physical activity, and the associated consequences of a generally hypoactive lifestyle (e.g., obesity, poor physical fitness)

[11], intriguing given the apparent correlation between the prevalence of NDBIDs in countries with similarly high levels of inactivity.

Motor coordination difficulties, or as Orton [12] described it sometime ago, "clumsy" children, a term still used today, comprise a major subset of children with NDBID. Other terms used to describe these difficulties include developmental dyspraxia, awkwardness, motor learning problems, and most recently, DCD [13]. While the hallmark feature of DCD has always been poor motor coordination [13], children with ASD and ADHD often met the criteria for DCD [14•], showing significant impairments in movement. Indeed, as Gillberg and colleagues [15] observed sometime ago, the co-occurrence of motor and attentional difficulties is the rule not the exception in children with NDBID. To this, recent research would add difficulties in social interaction and functioning, consistent with the symptoms of ASD.

With such a large number of children affected, and given the centrality of motor ability/function to the presentation of these conditions, physical literacy should occupy a central place in discussions regarding identification, diagnosis, and intervention. To date though, the field has been mostly silent on what physical literacy has to offer in this regard. This might be due to the conflation of physical literacy with fundamental movement skill, and the absence of yet an agreed upon measure of the concept, suitable for evaluation purposes. At present, the following four tests of motor development are by far the most frequently used to assess and evaluate children with movement difficulties: (1) the Bruininks–Oseretsky Test of Motor Proficiency (BOTMP) [16]; (2) the Movement Assessment Battery for Children (MABC) [17]; (3) the Peabody Developmental Motor Scales (PDMS) [18]; and (4) the Test of Gross Motor Development (TGMD) [19]. None of these measures includes motivational or affective domains specific to movement, nor do they assess a broad or diverse range of movement competencies, consistent with the definition of physical literacy. There has, however, been some development in the field of measurement related to physical literacy that offers at least the potential to supplement existing scales of motor ability or motor problems through a lens of movement potential. The Canadian Assessment of Physical Literacy (CAPL), for example, includes both movement skill assessments and measures of predilection and perceived adequacy toward physical activity [20], among other measures (e.g., physical fitness). The Physical Literacy Assessment for Youth (PLAY) tools, while still being evaluated, also combine assessment of core movement skills/competences, with evaluations of confidence, perceived competence, and enjoyment [21]. If we re-position the deficits in motor skill in NDBID argument, to focus on movement potential and competencies specific to the child, as is consistent with a physical literacy approach, then these tools may offer some promise for future evaluation. However, physical literacy is more than just

“assessment”; the approach to learning subsumed in it also has potential to offer much to identification and support of children with NDBIDs.

### The Importance of Human Movement and Physical Literacy in Understanding Early Development of NDBIDs

Human movement has played a major role in the evolution of the human brain. It is not simply the expression of motor intention but is the product of coordinated brain function and is the primary medium through which a child interacts and learns about the world. Human movement through our existential experience therefore becomes the medium in which neuromotor skills are developed, maintained, and enhanced. A growing body of research indicates that immature neuromotor development is linked to NDBIDs in children and adolescents [22].

Most scholars agree that physical literacy begins to develop from the moment a child is born [23]. The process begins in infancy with competence, confidence, and motivation continuing to be developed over time through experience and practice. Physical literacy begins with mastery of the body in space, the physical sense of self and security in space, and the development of a rich vocabulary of non-verbal skills as well as supporting verbal expression in social environments.

Given the close connections between early brain development, NDBIDs, and physical literacy, departures in development or stunted/delayed expression of physical literacy could be one lens through which to view children with potential NDBIDs. Assessment of physical literacy in place of more conventional assessments of motor ability/skill or motor developmental milestones, alongside assessment of other developmental domains (e.g., language, cognition), could increase the potential for early identification of children with or at risk for NDBIDs. Indeed, the fact that the concept embodies multiple affective and motivational domains, as well as context (physical and social environment), as noted above, is quite distinct from other assessment approaches that tend to be more reductionist (e.g., specific FMS). Physical literacy offers at least the potential for achieving a richer evaluation of movement (and therefore movement problems).

### Challenges of Early Development Screening

In the past two decades, more attention has been given to early identification and intervention of children with NDBIDs. The literature is scattered among several streams of research, which often have been developed independently of one another with little cross-reference. There appear to be six main streams: (1) infant mental health and psychiatry; (2) child

development of infants and toddlers at sociocultural and/or biological risk for developmental delays; (3) psychometric assessment of at risk dimensions of psychopathology among young children and those with established disabilities, e.g., severe developmental, genetic, and neurobiological disorders; (4) behavioral studies of individuals with socially mediated behavior problems and disabilities using direct observations of behavior and single-subject designs; (5) animal models of NDBIDs and stereotyped behavior; and (6) genetic and neurobiological factors related to NDBIDs.

The lack of interdisciplinary collaboration among clinicians and with key stakeholders has made screening children for NDBIDs difficult in this regard as natural variability in attainment of milestone means it is difficult to separate “real delay/disorder” from “slow” to develop. This can potentially lead to misdiagnosis, over-diagnosis, and many other potential patient and system problems. Long periods of observation are needed during the early years of learning (probably from 3 years onward) when a child has the ability to speak sentences using a subject, verb, and object which is understandable by strangers, asks questions what, where, and who and understands more complex instructions. It is also at this age children can participate in all four domains of observable physical literacy as described by Dudley [5••] including basic object locomotion activities such as riding a tricycle and using skis.

Given that the manifestations of NDBID behavior are often divergent to the progression of behaviors advocated in physical literacy models and that it adopts strengths rather than deficit-based diagnosis process, there may be an opportunity for a new and novel avenue of screening to be considered for NDBIDs.

Early years, educators and clinicians need to separate children with poor motor owing to NDBIDs from motor learning problems, from slow to develop, from lack of experiential opportunity. The development of strength-based physical literacy assessments could be implemented into pre-school, school, and clinical settings in order to repeatedly assess and track a child’s physical literacy journey. Furthermore, these types of assessment instruments would not only assist in the identification of children with NDBIDs, but act as a mechanism for treatment as well. Putting the emphasis on assessment first rather than treatment becomes a strong pedagogical imperative for educators and these individuals will ultimately be the first responders in working with children with NDBIDs. Assessments of learning will always become the enacted curricula by schools and teachers [24] and hence predicate the treatment response.

This manner of thinking would be revolutionary in the treatment of children with NDBIDs in educational and clinical settings. In education, we talk about “response to intervention” as a paradigm for testing and re-testing a child’s capability (over time, assessment, modification, re-assessment,

modification, etc.). Embedding physical literacy assessment in early childhood settings establishes a curriculum for helping sort the children in need of support from the child who simply needs time and opportunity to develop skill. It is therefore both enacted screening and an instruction mechanism. It would allow institutions to monitor how a child is progressing (or not) and experiment (change the task, modify the environment, offer support) in line with a dynamic system approach to motor learning/development [25]. This in turn would determine if progress is enhanced, and eventually if progress is stunted, referral or collaborations with other clinical and non-clinical professionals can occur to provide additional support.

### Potential for Physical Literacy Screening Instrument of NDBIDs

Universal programs of physical literacy in the early years using a clinical approach to teaching [26•] whereby by learning is diagnosed, interventions are based on best evidence, and effect evaluated before further diagnosis can achieve two important objectives. One, support the development of physical literacy for all children and in doing so, two, facilitate identification of children with NDBIDs. The justification for the first objective can be found in the accepted high rates of physical inactivity and overweight/obesity in the general pediatric population [27]. Given the centrality of physical literacy to physical activity [1, 2], universal programs to substantiate physical literacy in the population are clearly warranted. The rationale for the second point is that through intervention targeting the developing of physical literacy, we can more easily identify children whose physical literacy journeys appear delayed or fixed. While not all these children have NDBIDs, it is likely that children who do will show difficulties developing many of the elements of physical literacy already identified in existing models of observed physical literacy behaviors [5••].

There have been recent calls for a universal learning approach to identify children with motor learning problems (Partnering 4 Change—P4C—program) [28]. The program involves putting occupational therapists in school settings to act as a resource to teaching, advising, coaching, and consulting on principles of motor development for the facilitation of identification of children with motor delay/motor difficulties. In this role, occupational therapists act as a kind of “public health” professional, whose job is not to assess individual children, but advise teachers on constructing supportive learning environments to develop motor skill. Children who respond positively can be selected out of referral streams; children who do not can be more easily identified and provided appropriate supports.

By contrast, the approach we advocate here differs in several fundamental ways. Incorporating the concept of physical literacy is already embedded in quality school curricula. It has been constructed largely in frameworks and models that can be applied and understood by teachers; therefore, it acts to support the development of all children. Although P4C has carefully selected a language and framework from within educational research, the therapist is still “external” to the system. Secondly, it speaks from a position of salutogenesis whereby it is acknowledged that all children have capacity and are traveling on their own movement journey. It will however recognize when that journey in an individual stalls and acts as a potential early diagnostic mechanism.

### Conclusion

While still an emergent concept, physical literacy as a potential lens for viewing movement development, both typical and atypical, holds promise for changing the way we identify children with NDBIDs. The concept is richer and more comprehensive than fundamental movement skills and can be incorporated into existing educational pedagogy because of its philosophical underpinnings and pragmatic implications. However, its promise has yet to be realized and requires rigorous evaluation before recommendation at a policy level.

### Compliance with Ethical Standards

**Conflict of Interest** Dean Dudley, Dean Kriellaars, and John Cairney declare that they have no conflict of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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