

Educating the Young Child

Advances in Theory and Research, Implications for Practice

Hannah Brewer · Mary Renck Jalongo  
*Editors*

# Physical Activity and Health Promotion in the Early Years

Effective Strategies for Early Childhood  
Educators

 Springer

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Advances in Theory and Research, Implications  
for Practice

Volume 14

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# Foreword

In recent years, I served as a content advisor for the longest-running children’s television program, *Sesame Street*. Although I was well-acquainted with the Muppets and the program that airs weekly in my community, delving further into the group’s work made me aware not only of the international footprint of *Sesame Street* but also their work in health and wellness. It was interesting to discover that they had produced a series of programs on “heart healthy” habits that aired in the USA, Canada, and Columbia. Underlying this initiative were at least two assumptions. First, that the early years are an opportunity to teach wellness concepts and establish healthy habits, and second, that encouraging regular physical activity and minimizing sedentary behavior are ways to counteract obesity and disease. This volume in the *Educating the Young Child Series* adopts a similar stance. The distinguished and diverse group of authors assembled here is unified by the conviction that the habit of physical activity, launched during in the early years, can exert a powerful and positive impact on young children’s health and fitness.

## Why Be Concerned About Young Children’s Physical Activity?

Where physical activity is concerned, there exists a persistent misconception that young children are “naturally” active and require no systematic opportunities, encouragement, or instruction to have a healthy lifestyle. Clearly, this is not the case. Internationally, there is concern that children are leading more sedentary lives, have much higher rates of obesity, and are setting in motion habits that will lead to compromised health (Carson et al., 2010; World Health Organization, 2012). It has been argued that contemporary young children are less fit and less active than ever before (American Academy of Pediatrics, 2016). How has this happened? Outside of school, vigorous activity for children often is restricted for a variety of reasons. Concerns about safety often keep children indoors rather than outdoors playing with

neighborhood children. Once inside, children tend to devote many hours to “screen time” with television, computers, smartphones, and electronic games, making them sedentary for much of the day. Moreover, many parents/guardians work long hours or multiple jobs, continue to be “wired in” and work after they arrive home, have household duties to perform, or are just too exhausted to be physically active after work. As a result, adults in the home may not provide models of moderate-to-vigorous physical activity on a regular basis. Studies also have suggested that many parents feel that they lack knowledge about how to encourage physical activity in their children, other than enrolling them in some sort of class or organized sports. Many of these programs are not well-suited for very young children

Opportunities to be physically active in educational settings are restricted as well. Few programs are meeting the “minimum daily requirement” of exercise for children. The Institute of Medicine (2011) recommends at least 15 minutes of physical activity for every hour spent in child care in order to prevent obesity. Yet, at the very time when research clearly documents the positive effects of both planned and informal physical activity on children’s overall health, many schools are reducing the amount of time allocated to vigorous physical activity (Ramstetter, Murray & Garner, 2010). In addition, both the pressure to attain higher academic standards and pressing budgetary considerations have reduced or eliminated many physical education classes. Few early childhood programs have the services of teachers with specialized expertise in physical education so this responsibility frequently is relegated to teachers who lack the preparation, skills, confidence, materials, and environments to lead children in physical activity.

Another damaging attitude toward children’s physical activity is a “talent scout” mentality in which only those children who appear to be gifted and talented athletically are given extensive support to develop their skills. Too often, children whose physical skills are regarded by adults as ordinary or deficient in some way are excluded if, for example, play areas are inaccessible to young children with special needs or if teachers fail to make the necessary accommodations that give everyone a chance to participate. Even adults who are physically active themselves may be misguided and focus on competition with others rather than performing at one’s personal best. This type of bias should be no more tolerated in the realm of opportunities for physical skill development than it is in opportunities for intellectual skill development. Collectively, these influences can undermine the goal of promoting active lifestyles for everyone.

## **What Is the Contribution of This Volume?**

An appreciation for the healthy mind and body connection has existed for centuries. In ancient Rome *Mens sana in corpore sano* (“a sound mind in a sound body”) was a goal for all citizens. This volume takes that ancient wisdom, applies it to the youngest children, and supports it with current empirical and international evidence—all with an eye toward improving wellness across the lifespan. The benefits

of physical activity for young children have attracted national attention as countries take action to promote health in their youngest citizens (Alberta Accreditation of Early Learning and Care Services, 2013; Centers for Disease Control, 2010). For example, when it was determined that one in five young children in New South Wales, Australia is obese, the country launched the Healthy Kids Eat Well, Be Active (New South Wales Ministry of Health, 2013) initiative. Their team concluded that more active, healthy habits benefit children by:

- Promoting healthy growth and development
- Helping to achieve and maintain a healthy weight
- Building strong bones and muscles
- Improving cardiovascular fitness
- Improving balance, coordination, and strength
- Maintaining and developing flexibility
- Improving posture
- Assisting with the development of gross motor and fine motor skills
- Providing the opportunity to develop fundamental movement skills
- Helping to establish connections between different parts of the brain
- Improving concentration and thinking skills
- Improving confidence and self-esteem
- Relieving stress and promoting relaxation
- Providing opportunities to develop social skills and make friends
- Improving sleep

Empirical evidence from various fields to support such assertions is mounting (Bowers, Green, Hemme & Chalip, 2014; Jensen, 2005; Mayo Clinic Staff, 2011). Collectively, these sources document that participation not only in structured but also in informal physical activity can set in motion habits and attitudes that affect all areas of development commencing in early childhood and continuing throughout life (Lu and Montague, 2016; Spark!, 2016).

## **Audience for the Book**

In reviewing the literature on physical activity and wellness, we identified two major shortcomings. First of all, there were very few books on the topic that focused on the age group of this volume, birth to eight years. This made most of the publications less applicable to the youngest children who are acquiring fundamental movement abilities. These include locomotor (e.g., walking, running, jumping, skipping), nonlocomotor (e.g., turning, twisting, nodding), and manipulative (e.g., throwing, catching, dribbling) (Robinson, 2011) (e.g., walk, hop, skip) rather than orchestrating sophisticated physical behavior repertoires, such as those required for participation in organized sports. Secondly, of the few books published, many of them were written for an audience of educators specializing in physical education rather than a more general population of teachers. Given that it is the “regular” early childhood



educator who most often is expected to plan and provide physical activity for young children, we saw a need to gather together experts in the field who could make the theory, research, and practice accessible to those without specialized preparation in physical education. Ideally, physical activity and healthful eating initiatives at home and at school during the early years would:

- Support development of “fundamental movement abilities” that affect coordination, balance, and attainment of physical education goals
- Contribute to every child’s self-concept and self-expression
- Enhance the development of academic skills as children learn to self-monitor and solve problems
- Build social skills as children learn to interpret gestures and the physical movements of others
- Address the “obesity epidemic” in a proactive way
- Shape the young child’s attitudes, values, beliefs, and habits about physical activity in ways that affect lifelong habits (Isenberg & Jalongo, 2016)

## Organization of the Volume

The book is organized into three sections: (1) Foundations of Physical Activity and Health Promotion in Early Childhood, (2) Research-Based Teaching Strategies to Promote Physical Activity and Health During Early Childhood, and (3) Physical Activity Programs and Preservice/Inservice Teacher Education. The chapters are replete with evidence-based strategies that support the efforts of early childhood educators in various roles, including child care providers, classroom teachers, pre-service educators, parent/family educators, and higher education faculty members.

## Conclusion

Increasingly, it is being argued that there is yet another type of literacy: physical literacy (McNulty & Prosser, 2011). It includes a repertoire of behaviors, habits, and wisdom about what bodies need to be healthy and well and, as with other types of literacy (e.g., print, information, technology), physical literacy requires major investments of time and support. Young children need much more than admonitions from adults in order to achieve this goal. To illustrate, I observed two preschool girls playing together in the block center. They had built a school and a home, and now a small wooden figure, used to represent a child, was returning home for an after-school snack. The child playing the mother’s role said, “Annah, let’s get a good snack for you” to which the preschooler playing the role of the child said, “OK, I want candy.” The first child protested, saying, “No, Annah. You have to say something that’s *good* for you” and her playmate answered, “But I like candy. It’s good.”

As the second child's candid comment suggests, it is not enough to tell children to be active and make more healthful choices. We need to practice it ourselves because it is one of those dispositions that is acquired, over time, primarily by emulating positive role models. This means that early childhood educators will need to reach out to families and communities. Early childhood educators worldwide will need to work together to advocate for the young child's wellness of body just as assiduously as they have advocated for developing the young child's intelligence and socioemotional skills. To that end, we bring to you this informative, expert, and interesting volume of the *Educating the Young Child*. We chose the edited book format so that we could bring together a chorus of expert opinion from different areas of specialization, all united by a focus on promoting the young child's physical literacy. In keeping with the goal of the series, our distinguished group of authors discusses advances in theory and research and demonstrates how they are using that evidence to improve professional practice and collaborate with families.

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## References

- Alberta Accreditation of Early Learning and Care Services. (2013). *The importance of physical literacy*. Retrieved November 1, 2016, from [http://www.aelcs.ca/Announcements/Reflective\\_Bulletins/Documents/The\\_Importance\\_of\\_Physical\\_Literacy.pdf](http://www.aelcs.ca/Announcements/Reflective_Bulletins/Documents/The_Importance_of_Physical_Literacy.pdf)
- American Academy of Pediatrics. (2016). *Early Childhood: 1–4 years*. Retrieved November 1, 2016 from <http://www.brightfutures.org/physicalactivity/pdf/EarlyChild.pdf>
- Bowers, M. T., Green, B. C., Hemme, F., & Chalip, L. (2014). Assessing the relationship between youth sport participation settings and creativity in adulthood. *Creativity Research Journal*, 26(3), 314–327.
- Carson, V., Clark, D., Ogden, N., Harber, V., & Kuzik, N. (2010). Short-term influence of revised provincial accreditation standards on physical activity, sedentary behavior, and weight status in Alberta, Canada child care centers. *Early Childhood Education Journal*, 43(6), 459–465. <https://doi.org/10.1007/s10643-015-0688-3>
- Centers for Disease Control. (2010). *The association between school-based physical activity, including physical education and academic performance*. Atlanta, GA: U.S. Department of Health and Human Services.
- Institute of Medicine (IOM). (2011). *Early childhood obesity prevention policies*. Washington, DC: The National Academies Press.
- Isenberg, J. P., & Jalongo, M. R. (2016). *Creative thinking and arts-based learning, K-2nd grade* (7th ed.).
- Jensen, E. (2005). *Teaching with the brain in mind* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.
- Lu, C., & Montague, B. (2016). Move to learn, learn to move: Prioritizing physical activity in early childhood education programming. *Early Childhood Education Journal*, 44(5), 409–417.
- Mayo Clinic Staff. (2011). *7 benefits of regular physical activity*. Retrieved November 1, 2016, from <http://www.mayoclinic.com/health/exercise/HQ01676>

- McNulty, C., & Prosser, T. (2011). Being active together: How to raise a physically educated child. *Childhood Education*, 87(3), 202–203.
- New South Wales Ministry of Health. (2013). *Benefits of being active*. Retrieved November 1, 2016, from <http://www.healthykids.nsw.gov.au/teachers-childcare/physical-activity.aspx>
- Ramstetter, C. L., Murray, R., & Garner, A. S. (2010). The crucial role of recess in schools. *Journal of School Health*, 80(11), 517–526.
- Robinson, L. E. (2011). The relationship between perceived physical competence and fundamental motor skills in preschool children. *Child: Care, Health and Development*, 37(4), 589–596.
- Spark! (2016). *Early childhood*. Retrieved November 1, 2016, from <http://www.sparkpe.org/early-childhood/>
- World Health Organization. (2012). *Obesity and overweight fact sheet*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs311/en/>

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**Part I**  
**Foundations of Physical Activity**  
**and Health Promotion in Early Childhood**

# Chapter 1

## Foundations of Physical Activity and Health Promotion in Early Childhood



Hannah J. Brewer

### Cultural Shifts in Daily Physical Activity

*In August, the week before Ms. Cook was to begin implementing a structured physical activity program at an early childhood education center, she walked into the center to meet the staff and get acquainted with the facilities. It was early in the morning, and as she entered the facility, she saw all of the children sitting quietly on mats on the floor. With their eyes wide, all of the children were attentive and contently watching morning television. The early childhood educators were getting materials ready for the day, greeting children and their caregivers as they came through the door, and helping each child store their personal belongings in the nearby cubbies.*

*As Ms. Cook gazed around the room, she couldn't help but think that all of the children looked healthy – healthy and happy. This scene is all too common in today's society. Children who are calm, quiet, and engrossed with technology appear to be safe and comfortable, making it sometimes difficult for parents and early childhood educators to see the negative ramifications of too much screen time – or other sedentary behaviors.*

*It became very clear to Ms. Cook that movement, in today's society, may not happen naturally among children and needs to be purposefully incorporated into daily routines.*

Physical activity and quality of life have gone hand-in-hand for centuries. Physical activity during early childhood is imperative for optimal growth and development, and the relationship between physical activity and quality of life dates back to the 1800s (Dauer & Pangrazi, 1975). Despite substantial evidence linking the importance of physical activity to optimal child development, according to Le Masurier and Corbin (2006), physical activity has been replaced by modern day conveniences and “engineered out of most aspects of daily life” (p. 44). This poses real and lasting

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challenges for children growing up in the twenty-first century. To combat these challenges, children must be provided with opportunities to be physically active throughout the day that help them develop motor skills, reduce their risk for chronic disease, understand the relationship between movement and wellness, and develop an appreciation for physical activity.

Childhood sedentary behavior is a complex system problem that emerged during the economic growth and globalization of the marketplace. Before 1990, movement was more or less engrained into everyday life – walking to school, riding bicycles through the neighborhood, and playing outside until dusk were common childhood activities. In today’s society, meeting physical activity guidelines no longer happens without concentrated efforts. Movement must be planned and purposefully incorporated into one’s daily routine. This does not mean that movement must be structured, but that children must be given proper time, space, equipment and skills to facilitate physical activity.

Today, meeting physical activity guidelines is often a learned and intentional behavior. Therefore, caregivers and early childhood educators must value health as a key part of learning and promote physical activity in early childhood settings. Helping children shape positive attitudes about physical activity is as important as incorporating adequate opportunities for physical activity into the daily routine. Shaping positive attitudes and embedding physical activity into a child’s day can be accomplished in a variety of ways, but the evidence is clear that physical activity needs to be considered a priority in early childhood education (Javanainen-Levonen, Poskiparta, Rintala, & Satomaa, 2009; Vidoni & Ignico, 2011).

A number of early childhood researchers suggest that both structured and unstructured physical activity are essential for proper physical, social, and cognitive development (Hinkley et al., 2014). This chapter investigates the importance of physical activity for (1) improved cognitive health and development, (2) better physical health, and (3) improved emotional well-being. The following section defines physical activity and sedentary behavior and provides an overview of the differences between structured and unstructured physical activity.

## Physical Activity Defined

Physical activity is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (Meeks, Heit, & Page, 2013, p. 240). While a significant proportion of children do not meet daily physical activity recommendations (Colley et al., 2011; Townsend, Wickramasinghe, Williams, Bhatnagar, & Rayner, 2015), physical activity in itself is enjoyable for most children. Young children are naturally inclined to move freely and explore spaces around them by jumping, spinning, and clapping. These are just a few of the unstructured movements young children typically enjoy.

Although children naturally enjoy physical activity, there is a misconception that because they enjoy it, they are “naturally” active and do not require any



encouragement or support to be physically active. This is far from the truth. In England, in 2012, only one in ten children aged 2–4 years met the recommended levels of physical activity (Townsend et al., 2015). In the United States, approximately one in four children met the age-specific Physical Activity Guidelines for Americans in 2008, and in Canada, less than 7% of children met the Canadian Physical Activity Guidelines on at least six days per week in 2009 (Colley et al., 2011). Although physical activity guidelines vary slightly from country to country, one common theme prevails: Most children today are not getting enough physical activity.

### ***Unstructured Physical Activity***

Unstructured physical activity is self-directed and allows children to explore their environment without restraint. Giving children time to engage in unstructured physical activity enhances creativity, self-expression, and cooperation (SPARK, 2016). Although unstructured physical activity is just that – unstructured, young children need to be presented with situations that encourage them to move in their own exploratory ways. This brings some sense of “structure” to unstructured physical activity in today’s early childhood environments. For example, 20 children moving freely through an open space with a scarf or ribbon while music plays in the background are engaging in unstructured physical activity, even though a teacher planned this experience into the day.

### ***Structured Physical Activity***

Structured physical activity is planned, directed, and has an instructional purpose. The purpose may be to develop gross motor skills, develop health-related physical fitness, or improve object control skills (Stodden & Goodway, 2007). Structured physical activity is specifically designed with the child’s developmental level in mind and can ensure that children are learning fundamental skills essential for Activities of Daily Living (ADL) such as coordination, stability, and spatial awareness. Specifically, structured physical activity would assist young children in developing the skills needed to alternate their feet as they walk up and down stairs and swing their arms as they walk or run to improve efficiency. Physical activity that is planned and purposeful assists children with object control and manipulation by helping them develop the proper form, stance, and follow-through for throwing or catching. Structured physical activity is also beneficial to ensure that young children are engaged in moderate-to-vigorous physical activity for the recommended amount of time (60 min for children ages 3–5 and children ages 6–17). During unstructured physical activity, children can generally choose the intensity level at which they would like to move at, oftentimes resulting in light or moderate physical activity.

Structured physical activity may more readily encourage children to move at a faster or more vigorous pace.

Physical activity recommendations for both children and adults often make reference to light, moderate, and vigorous physical activity. Casual walking or light dancing are considered light intensity physical activity, brisk walking, walking uphill, or using most playground equipment is considered moderate physical activity, and running or jumping rope are considered vigorous physical activity (Lee & Paffenbarger, 2000). The phrase moderate-to-vigorous physical activity (MVPA) describes bodily movement fast enough to burn three to six times as many calories per minute than would be burnt at rest (sitting quietly). Specifically, MVPA refers to activities that burn three to six METs (metabolic equivalent) while vigorous-intensity activities burn more than six METs. One MET stands for the amount of oxygen consumed and the number of calories burnt at rest (Harvard School of Public Health, 2016).

## Physical Activity Guidelines

Physical activity guidelines vary slightly between states and countries, but recommendations internationally require that children (up to 8 years of age) obtain a minimum of 60 min of physical activity each day (Centers for Disease Control and Prevention, 2016). The National Association for Sport and Physical Education (NASPE) recommends that children receive 60 min of unstructured physical activity per day in addition to 60 min of structured physical activity per day. The only difference in physical activity guidelines for children ages 3–5 and children ages 6–17 is that 3–5 year olds need 60 min of unstructured physical activity in addition to 60 min of structured physical activity each day. Further, children should not be sitting or lying for more than 60 min at a time unless they are sleeping. This recommendation confirms that young children (ages 3–5 specifically) should engage in at least 2 h of physical activity per day. Hinkley et al. (2014) summarized physical activity and sedentary behavior guidelines from Canada, Australia, the United Kingdom, and the United States and concluded that for optimal health, children need even more than 2 h of physical activity per day. Specifically, “children younger than school age and capable of walking should accumulate 3 hours of physical activity (PA) each day” (Hinkley et al., 2014, p. 183).

Although past research suggests that most of the health-enhancing benefits of physical activity are gained through moderate-to-vigorous physical activity, new research suggests that activities that feel even mildly uncomfortable for children may discourage future participation in physical activity (Seger, 2015). In support of this finding, identifying physical activities that are pleasurable for children— whether light, moderate, vigorous, or a combination of intensity levels, may be more important in early childhood than ensuring children engage in moderate-to-vigorous physical activity for a certain period of time.

## *Sedentary Behavior*

Sedentary behaviors are associated with adverse health outcomes in children. Sedentary behavior requires little energy expenditure and refers to any activity completed in a seated posture or lying posture while the body is awake. Sleeping is not considered sedentary behavior unless the individual is sleeping repeatedly during the day or oversleeping. More specifically, sedentary behavior is defined as an energy expenditure of less than or equal to 1.5 metabolic equivalents during a waking activity (Australian Department of Health, 2014a, b). Common sedentary behaviors among children include watching television, computer, video game, and internet use, and riding in a car. The term sedentary is sometimes used interchangeably with the term inactive.

Sedentary behavior is difficult to quantify, but research suggests there is a dose-response relationships between sedentary behavior and risks for overweight and obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease (Colberg, 2012; Matthews et al., 2008). This means, the more time a child spends in sedentary behaviors, the higher his or her risk becomes for these chronic conditions. Because of this dose-response relationship, many countries have created sedentary behavior guidelines to supplement physical activity guidelines. A child who engages in 60 min of structured physical activity per day but spends the rest of the day sitting will be more at-risk for chronic health conditions than a child who takes activity breaks throughout the day in addition to his or her 60 min of physical activity. Brain breaks, movement breaks, walking, or simply standing instead of sitting provide clear health benefits, even if just completed for a short amount of time. All movement counts. All movement is beneficial, even if it is just 30 s of walking between learning stations or 3 min of using the whole body to spell words between sedentary classroom activities.

A recent report by Pate, Mitchell, Byun, and Dowda (2011) found that higher levels of sedentary behavior were reported in non-white children, children from lower socioeconomic backgrounds, and children from households with more access to televisions, computers, or the internet. When parents or caregivers set rules or limitations on screen time, lower levels of sedentary behavior were reported. These health disparities should be considered when working with children who are more at-risk for sedentary behavior.

Acknowledging the importance of not only increasing physical activity but also decreasing sedentary behavior has led to new health campaigns such as “Sitting is the New Smoking” and “Limit Sit Time to Increase Fit Time” (Yoder-Wise, 2014). These two campaigns portray the importance of all movement throughout the day and the risks associated with a sedentary lifestyle. To truly meet early childhood activity guidelines, movement must become engrained into children’s everyday experiences instead of being taught exclusively during exercise time/physical education class. Australia’s Physical Activity and Sedentary Behavior Guidelines for Children recommend breaking up long periods of sitting as much as possible, and provide the following specific suggestions for decreasing sedentary behavior among

children: (1) Reward positive behavior with active family time instead of with electronic media use, (2) Allocate specific time periods for electronic media use, preferably not during daylight hours, (3) Turn the television and other electronic media devices off during meal times, (4.) Make bedrooms electronic media-free zones, (5) Store portable electronic devices out of sight, and (6) Set a good example by reducing media use for entertainment.

Reducing screen time and sedentary behavior among children is a simple, yet tangible way to improve health and well-being. In addition to reducing screen time, Castelli and Ward (2012) presented several ways to reduce sedentary behavior in early childhood settings and elementary schools outside of structured physical education classes. It is important to recognize that physical education classes taught by certified Physical Education Teachers are a key component to quality education. Yet, time spent in physical education classes, especially in early childhood, rarely provides adequate physical activity time to meet physical activity guidelines. To complement physical education classes, Castelli and Ward (2012) recommend: (1) Morning physical activity, (2) Physical activity breaks in the classroom, (3) Physical activity rewards and incentives, and (4) Content-rich physical activity. In addition, all early childhood educators must value and promote physical activity since health and learning are intimately linked. The next section will discuss why attitudes associated with physical activity and the methods used to introduce and encourage physical activity in early childhood are as important as meeting the time requirements or “minutes of physical activity required per day.”

## **Early Enjoyment of Physical Activity and Lifelong Health**

Despite countless interventions designed to increase physical activity and combat obesity in children, Michelle Segar, behavior expert and author of *No Sweat*, reports that enjoyment of physical activity, not short-term weight loss or knowledge of how physical activity benefits health, is the strongest predictor for maintaining a health-enhancing level of physical activity throughout the lifespan. Physical activity must be enjoyable in order for it to be sustainable. Experiences during early childhood have the power to shape individuals’ views about physical activity for a lifetime. These views can be positive or negative, depending on each child’s unique experience. Take, for example, the child who remembers finishing last in a relay race and feeling as though she is the reason her team does not win the race. This experience may cause the child to avoid running, skipping, galloping, or whatever movement she associates with that particular event. The negative image accrued through this specific life experience has the potential to impact other types of physical activity as well, causing the individual to avoid all types of physical activity in the future – even ones completely unassociated with the relay event (Segar, 2015). Most adults who have a negative perception of physical activity can identify one or more events in their past that shaped these negative views. Physical activity experiences during childhood have a powerful influence on future behaviors.

In contrast to this example, imagine a child who loves music and is given permission to listen to headphones while walking around the perimeter of the playground. This child who associates positive feelings with physical activity is more likely to choose walking or other forms of physical activity in the future to reduce stress, or just for fun. He enjoys music and feels good about being able to walk while listening to something important to him. Although he may never reach his target heart rate training zone during the walk, he is much more likely to pick up his headphones and head out for a walk in the future than the child who associates negative feelings with physical activity. The Surgeon General created a call to action to increase walking as a form of physical activity for all age groups (US Department of Health and Human Services, 2016). Walking does not require special skills, facilities, or expensive equipment and is accessible to most children. Walking also assists children in beginning and maintaining a physically active lifestyle. Although some fitness enthusiasts may still believe that vigorous physical activity is essential, Seger (2015) stated that “the 20 minute walk you are doing every day is more beneficial than the five mile run you are not doing” (p. 117). Because humans are hard wired to repeat behaviors that feel good to them and avoid behaviors that are unpleasant, fostering enjoyment of physical activity in early childhood provides both immediate and long-term benefits.

A child’s decision to continue to be active on his own is often based on how he perceives physical activity. If it feels as though physical activity is a chore, he will avoid it until a teacher, parent, coach, or doctor prescribes it. If he feels like physical activity is a gift or a treat, he will find ways to incorporate physical activity into his day without hesitation. This approach uses emotion and personal fulfillment as a means for encouraging physical activity instead of desired health outcomes or weight loss as the end goal. Research consistently shows that engaging in physical activity specifically to address health outcomes (body composition, blood pressure, cholesterol, blood sugar, triglyceride levels, etc.,) can be effective in the short term but generally does not lead to lifelong behavioral change (Jakicic et al., 2015). On the contrary, engaging in physical activity because it feels good, clears one’s mind, provides enjoyment, or reduces stress is much more likely to lead to sustainable physical activity habits. Although this text will include the importance of physical activity in early childhood for improving children’s physical health, the primary focus will be on creating a culture of wellness in early childhood education where physical activity (both structured and unstructured) is not seen as an add-on or “break” from learning, but instead, as an integral part of the learning and living process.

## **Children’s Cognitive Health and Development**

Early childhood is a time when experiences in physical activity can be broadened, pleasure can be found in movement, and realistic ways physical activity can be incorporated into everyday lives can be discovered. This section will focus on how physical activity is associated with improved cognitive health among children.

A number of researchers and psychologists conclude that strong connections exist between movement and learning. In fact, healthy brain development is incumbent upon physical activity (Davis et al., 2011; Gartrell & Sonsteng, 2008). Critical parts of the body develop at different rates, and certain childhood physical activities facilitate the development of sensory organs.

Specifically, the vestibular, also known as the inner-ear, is the first sensory organ to mature. The inner-ear and the cerebellar system serve to help gather information about movement and send messages to other parts of the body. The vestibular and cerebellar system helps children maintain focus and attention. They are highly important for assisting with proper delivery of impulses traveling through the nervous system. Stimulation of the inner-ear during early childhood (through physical activity) improves the development of these sensory functions (Jensen, 2005). Movements such as swinging, rolling, jumping, tumbling, and rocking strengthen the ability of the sensory system to respond quickly to stimuli.

The reticular activating system (RAS) consists of a set of connected nuclei in the brain, and also benefits from these types of physical movement. A well-developed RAS helps children with balance, responding to impulses, and initiating movements. The RAS, which is found in the brainstem, serves as an essential neural component of the sleep/wake cycle (Jensen, 2005). Playground equipment is often constructed intentionally to encourage children to participate in activities that stimulate the inner ear and the RAS. Providing opportunities for children to spin, rock, tumble, flip upside down, and use playground facilities that encourage these movements is supportive of improving their cognitive health.

Palmer (2003) conducted several studies examining the effect of early motor stimulation on listening skills, reading comprehension, and writing ability. Almost universally, children in her Smart Start program which focused on improving children's sensory motor system at an early age demonstrated better attention and listening skills than children in the control group (Palmer, 2003). This is one example of how physical movements improve cognition. Hung, Chang, Tang, & Shih (2008) conducted a study with a population of 5 year olds to examine the effect of physical activity on brain development in young children. An equally matched experimental and control group were used to ensure that the results could be attributed to the addition of physical activity and not other confounding factors. After a 6 month structured physical activity program, children in the physical activity group had higher electroencephalography (EEG) power in the delta bands for the frontal, temporal, and central areas of the brain than children in the control group. The physical activity group also had higher EEG power at the theta band for the frontal area. EEG is a relatively noninvasive method used to track and record electrical activity of the brain that places electrodes along the scalp. This example demonstrates that physical activity is linked not only to brain development, but also to brain activity and responsiveness.

Further research suggests that the cerebellum, the part of the brain known for regulating motor control, is also responsible for processing learning (or academic content). Thinking, anticipating movements, and making predictions before carrying out actions are primary functions of the cerebellum. This thought-action process

suggests that movement and cognition are intricately linked because engaging in physical activity often requires young children to make quick decisions about how they will move. This includes body awareness, movement, and reaction time—all of which improve the reactivity of the cerebellum. Jensen (2005) reported that “the cerebellum can make predictive and corrective actions regardless of whether it’s dealing with a gross-motor task sequence or a mentally rehearsed task sequence” (p. 62). This concept implies that engaging in activities that encourage mental processes of the cerebellum such as prediction, sequencing, ordering, and rehearsing (often achievable through sports, motor skills, and other forms of physical activity) not only enhances coordination of physical movements, but also improves receptiveness to cognitive functions.

More evidence supporting physical activity as part of human development was offered by Anderson, Eckburg, and Relucio (2002). Their research discovered that people who were physically active had more cortical mass than those who were sedentary. Cortical mass refers to the weight and thickness of the brain’s cortex. Physical activity increases oxygen flow to the brain, and as blood flow increases, more nutrients are transported to the brain. Neurotrophins, also referred to as “brain food” are carried in the blood, and sitting still for extended periods of time weakens the flow of blood, oxygen, and neurotrophins to the brain. This is another example of how physical activity plays a key role in healthy brain development and may explain why, in addition to accumulating 2 h of physical activity per day, the NASPE recommends that “preschoolers should not be sedentary for more than 60 minutes at a time except when sleeping” (NASPE, 2010). Since the benefits of physical activity extend well beyond cognitive development, the following section presents the positive impact physical activity has on physical health and well-being.

## Children’s Physical Health

Individuals begin to develop physical activity habits at a young age (Eliassen, 2011). Improving physical activity habits during childhood and before profound health complications have the opportunity to surface has become an international priority. Healthy People (2020) Objectives include reducing the proportion of children ages 2–5 who are overweight or obese, reducing the percent of children ages 6–11 who are overweight or obese, and preventing inappropriate weight gain in children ages 2–5 and 6–11 (Healthy People 2020). These national objectives were developed specifically to improve health outcomes based on epidemiological data linking the top causes of death in most developed countries (diseases of the heart, malignant neoplasms, and cerebrovascular disease) to modifiable risk-factors, including physical inactivity during childhood (Cottrell, Girvan, McKenzie, & Seabert, 2015).

A primary cause of childhood obesity is lack of physical activity. Recent initiatives have been implemented on the international, national, and local levels to improve the health of the nation starting with the youngest learners- children. As a



result of these efforts, obesity rates among children in developed countries have stabilized (Wabitsch, Moss, & Kromeyer-Hauschild, 2014). This was an unexpected finding because in the United States, it was projected that the prevalence of obesity in children would reach 30% by 2030 (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). Making physical activity and proper nutrition a high priority in public health today has resulted in minor improvements in the prevalence of childhood obesity.

Despite these improvements, when the data are more closely examined, evidence shows that the heaviest children have become heavier, and obesity rates among children of low socioeconomic backgrounds have not declined (Claire Wang, Gortmaker, & Taveras, 2011). In fact, the prevalence of childhood overweight and obesity in low income families is still increasing. Because of this health disparity, it is important to continue public health programs that prevent childhood obesity and expand programmatic offering for obesity prevention in communities where children are most at-risk for becoming overweight or obese.

Cardiovascular disease is the leading cause of death in the United States, and obese and even slightly overweight children are inclined to cardiovascular risk factors. High blood pressure, high blood triglycerides, and elevated blood sugar are common among children who do not meet daily physical activity requirements (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Kalavainen, Korppi, & Nuutinen, 2007). Although cardiovascular disease has historically been considered a “disease of aging”, health experts know that childhood sedentary behaviors contribute to cardiovascular disease becoming a “disease of lifestyle”. Hong (2010) reported that atherosclerosis (deposits of plaque on the inner artery walls) typically manifests itself clinically in middle or late adulthood. Yet, the asymptomatic phase of plaque development begins much earlier in life. It begins during childhood. Furthermore, children with hypertension (continually elevated blood pressure) are more likely to have hypertension as an adult and physical activity is one of the most effective ways for young children to reduce their risk for hypertension.

The development of Type 2 Diabetes is complex and linked to multiple modifiable and nonmodifiable risk factors including genetics, the environment, and lifestyle. Yet, strong evidence links childhood obesity and physical inactivity to the development of insulin resistance and Type 2 Diabetes (Bartz & Freemark, 2012). The Bogalusa Heart Study and Cardiovascular Risk in Young Finns Study conducted a longitudinal study that examined a large cohort of children for over 20 years. They concluded that childhood obesity was the strongest predictor for developing insulin resistance or future diabetes later in life. Specifically, obese children had three times the risk of developing Type 2 Diabetes later in life than their healthy-weight counterparts (Bartz & Freemark, 2012).

There is a correlation between physical activity and physical health both during childhood and throughout the lifespan. Concentrated public health efforts to address childhood obesity may have helped put a halt on the climbing obesity rates, but there is still more work to be done. Together, clear recommendations from the United States Department of Agriculture (USDA) to decrease the consumption of



sugar-sweetened soft drinks among children and increase physical activity may have helped curb obesity rates.

Research on the complications associated with childhood obesity is abundant. Physicians, early childhood educators, and most caregivers now acknowledge the importance of reducing children's screen time, decreasing children's sugar consumption, and increasing children's opportunities for physical activity. Now, the focus must be directed towards shaping healthy habits during early childhood that are sustainable for a lifetime, and ensuring that early learning centers adhere to the physical activity guidelines that are known to benefit children.

## Children's Well-Being

Physical activity is not only a vehicle for improving cognitive and physical health, but also a gift that can help children feel well a regular basis. This includes social and emotional wellness. Although there is little research on how physical activity affects young children's social and emotional health, research relating to adolescents' physical activity and social and emotional well-being is so strong that new standards have been put into place in some public schools to improve emotional health including suicide prevention (Association for Supervision and Curriculum Development, 2014). Specifically, adolescents who were physically active on four or more days per week had a 23% reduction in both suicidal ideation and attempt among bullied adolescents in the United States (Sibold, Edwards, Murray-Close, & Hudziak, 2015). Physical activity frequency was inversely related to sadness and suicidality. There are clear psychological benefits of physical activity and these benefits may extend beyond bullying victims and beyond this specific age group of adolescents.

Although research on young children's emotional health is less robust, there is evidence suggesting that more children may be suffering from anxiety or depression today than in the past. Unicef, the UN children's agency, reported that family life is in crisis and that children's unhappiness may be linked to rampant consumerism and parents' long working hours. Even though Britain is the fifth wealthiest country in the world, British children reportedly suffer from more emotional health issues than any other country in the world. British children are also the most tested in the world which reportedly leads to anxiety at a young age (Livingstone, 2011). Being physically active may improve children's well-being and reduce feelings of stress and anxiety. Greco and Ison (2014) researched the factors that bring happiness to Argentine children. When asking children "what makes you happy" during structured focus groups, most children referred to interpersonal relationships as their first response (i.e., "I am happy when I play with my siblings," or "I am happy when I go to my grandparents"). Second, children began listing recreational activities such as "riding my bike around the neighborhood" "playing with my classmates at break time" or "playing games outside". This research demonstrates the social and emotional benefits of physical activity on children's overall well-being and happiness.

According to the National Center for Infants, Toddlers, and Families, keeping children healthy through adequate nutrition and physical activity is one of the most important roles of parenting (Zero to Three, 2016). Second, Eric Barker (2014) provided a list of ways to raise happy kids. Among this list were (1) creating positive relationships with parents and caregivers, (2) providing opportunities for the child to feel competent in something, or more specifically, mastery, (3) teaching self-care skills including hygiene, healthy eating, adequate sleep, meditation, and regular physical activity, and (4) cultivating fun or enjoying life. Evidence suggests that regular physical activity is not only enjoyable for children, but is required for health, vitality, and happiness.

## Early Childhood Educator's Role

National Association for Sport and Physical Education for NASPE and Association for Supervision, Curriculum, and Development for ASCD declares that getting an “active start” is a promising way to promote lifetime physical activity (2010) and health. Having access to safe indoor and outdoor facilities that encourage movement is necessary for young children to gain the full benefits of physical activity. As such, early childhood educators should be cognizant of the indoor and outdoor environments available for children, and maximize the potential of the environment to give children Opportunities to Move (OTMs). This could mean such things as using a hillside next to the playground to march up and down once before going back inside after outdoor play time, bringing rideable or movable toys outside on nice days to encourage young children to be more physically active, writing a grant to request physical activity equipment that promotes gross motor movements, or simply rearranging chairs, desks, and furniture inside to allow for more open space to move in between seated activities without risking injury.

According to the American Heart Association's Physical Activity and Public Health Guidelines (2007), intermittent bouts of physical activity throughout the day can add up to the recommended 1–3 h of daily physical activity recommended for young children. Although there are multiple health benefits associated with elevating the heart rate for an extended period of time, similar benefits can be achieved through engaging in small increments of physical activity. Even brief aerobic activities strengthen the heart and improve the body's ability to deliver oxygen to its cells. Therefore, early childhood educators can utilize small increments of time throughout the day for OTMs. For example, this could be as simple as telling the children they are going to take the long way to the drinking fountain and take a community walk around the outer perimeter of the classroom instead of walking straight to the drinking fountain. Another example is for teachers to lead children through three simple stretches or yoga exercises before nap time or story time. This encourages physical activity and helps them relax and transition into a quieter activity.

## Summary

In the opening scenario, the early childhood educators did not see anything immediately wrong with their current educational model because the children were quiet and happy. Although parents, caregivers, and educators have different values, teaching strategies, and parenting styles, one concept all caregivers of young children can agree upon is that they want their children to be happy and healthy (Syrad et al., 2015). Decreasing screen time and sedentary behaviors while providing opportunities for young children to be physically active allows for (1) improved cognitive health and development, (2) better physical health, and (3) improved emotional well-being. Teachers who value physical activity as an integral component of their early childhood curriculum are helping create a better society, starting with our most important resource – our children.

## References

- American Heart Association. (2007). *Physical activity and public health guidelines*. Retrieved from: <http://www.americanheart.org/presenter.jhtml?identifier=1200013>
- Anderson, B. J., Eckburg, P. B., & Relucio, K. I. (2002). Alterations in the thickness of motor cortical subregions after motor-skill and exercise. *Learning and Memory*, 9(1), 9–1.
- Association for Supervision and Curriculum Development. (2014). *Learning and health: Whole School, Whole Community, Whole Child (WSCC)*. Retrieved from: <http://www.ascd.org/programs/learning-and-health/wsc-model.aspx>
- Australian Government Department of Health. (2014a). *Sedentary behavior*. Retrieved from: <http://www.health.gov.au/internet/main/publishing.nsf/content/sbehaviour>
- Australian Government Department of Health. (2014b). *Australia's physical activity and sedentary behavior guidelines*. Retrieved from: <http://www.health.gov.au/internet/main/publishing.nsf/content/health-pubhlth-strateg-phys-act-guidelines>
- Barker, E. (2014, March). How to raise happy kids: 10 steps backed my science. *Time Magazine*. <http://time.com/35496/how-to-raise-happy-kids-10-steps-backed-by-science/>
- Bartz, S., & Freemark, M. (2012). Pathogenesis and prevention of type 2 diabetes: Parental determinants, breastfeeding, and early childhood nutrition. *Current Diabetes Reports*, 12(1), 82–87.
- Castelli, D. M., & Ward, K. (2012). Physical activity during the school day: Physical activity breaks can help children learn. *Journal of Physical Education, Recreation & Dance*, 83(6), 20.
- Centers for Disease Control and Prevention (CDC). (2016). *Division of nutrition, physical activity, and obesity: How much physical activity do children need?* Retrieved from: <http://www.cdc.gov/physicalactivity/basics/children>
- Claire Wang, Y., Gortmaker, S. L., & Taveras, E. M. (2011). Trends and racial/ethnic disparities in severe obesity among US children and adolescents, 1976–2006. *International Journal of Pediatric Obesity*, 6(1), 12–20.
- Colberg, S. R. (2012). Physical activity: The forgotten tool for type 2 diabetes management. *Frontiers in Endocrinology*, 3, 70. <https://doi.org/10.3389/fendo.2012.00070>
- Colley, R. C., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. S. (2011). Physical activity levels of Canadian children and youth. *Health Reports*, 22(1), 15–25.
- Cottrell, R., Girvan, J., McKenzie, J., & Seabert, D. (2015). *Principles and foundations of health promotion and education* (6th ed.). Boston, MA: Pearson.

- Dauer, V. P., & Pangrazi, R. P. (1975). *Dynamic education for elementary school children* (5th ed.). Minneapolis, MN: Burgess Publishing Company.
- Davis, C. L., Tomporowski, P. D., McDowell, J. E., Austin, B. P., Miller, P. H., Yanasak, N. E., ... Naglieri, J. A. (2011). Exercise improves executive function and achievement and alters brain activation in overweight children: A randomized, controlled trial. *Health Psychology, 30*(1), 91–98.
- Eliassen, E. K. (2011). The impact of teachers and families on young children's eating behaviors. *Young Children, 66*(2), 84–89.
- Freedman, D. S., Mei, Z., Srinivasan, S. R., Berenson, G. S., & Dietz, W. H. (2007). Cardiovascular risk factors and excess adiposity among overweight children and adolescents: The Bogalusa Heart Study. *Juvenile Pediatrics, 50*(1), 12–17.
- Gartrell, D., & Sonsteng, K. (2008). Promote physical activity- it's proactive guidance. *Young Children, 63*(2), 51–53.
- Greco, C., & Ison, M. S. (2014). What makes you happy? Appreciating the reasons that bring happiness to Argentine children living in vulnerable social contexts. *The Journal of Latino-Latin American Studies, 6*(1), 4–18.
- Harvard T.H. Chan School of Public Health. (2016). *Obesity Prevention Source*. Examples of Moderate and Vigorous Physical Activity: Retrieved from: <http://www.hsph.harvard.edu/obesity-prevention-source/moderate-and-vigorous-physical-activity>
- Healthy People. (2020). Office of Health Promotion and Disease Prevention. *Nutrition and weight* status. Retrieved from: <http://www.healthypeople.gov/2020/topics-objectives/topic/nutrition-and-weight-status/objectives>
- Hinkley, T., Teychenne, M., Downing, K. L., Ball, K., Salmon, J., & Hesketh, K. D. (2014). Early childhood physical activity, sedentary behaviors and psychosocial well-being: A systematic review. *Preventive Medicine, 62*(2014), 182–192.
- Hong, Y. M. (2010). Atherosclerotic cardiovascular disease beginning in childhood. *Korean Circulation Journal, 40*(1), 1–9.
- Hung, T. M., Chang, T. C., Tang, H. C., & Shih, H. H. (2008). Does physical activity affect brain development in young children? *International Journal of Psychophysiology, 69*(3), 276–277.
- Jakicic, J. M., King, W. C., Marcus, M. D., Davis, K. K., Helsel, D., Rickman, A. D., ... Belle, S. H. (2015). Short-term weight loss with diet and physical activity in young adults: The IDEA Study. *Obesity, 23*(12), 2385–2397.
- Javanainen-Levonen, T., Poskiparta, M., Rintala, P., & Satomaa, P. (2009). Public health nurses' approaches to early childhood physical activity in Finland. *Journal of Child Health Care, 13*(1), 30–45.
- Jensen, E. (2005). *Teaching with the brain in mind* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.
- Kalavainen, M. P., Korppi, M. O., & Nuutinen, O. M. (2007). Clinical efficacy of group-based treatment for childhood obesity compared with routinely given individual counseling. *International Journal of Obesity, 31*, 1500–1508.
- Le Masurier, G., & Corbin, C. B. (2006). Top 10 reasons for quality physical education. *Journal of Physical Education Recreation and Dance, 77*(6), 44–53.
- Lee, I. M., & Paffenbarger, R. S., Jr. (2000). Associations of light, moderate, and vigorous intensity physical activity with longevity. The Harvard Alumni Health Study. *American Journal of Epidemiology, 151*(3), 293.
- Livingstone, T. (2011). What really makes our children happy. *The Telegraph*. <http://www.telegraph.co.uk/news/health/children/8771115/What-really-makes-our-children-happy.html>
- Matthews, C. E., Chen, K. Y., Freedson, P. S., Buchowski, M. S., Beech, B. M., Pate, R. R., ... Troiano, R. P. (2008). Amount of time spent in sedentary behaviors in the United States, 2003–2004. *American Journal of Epidemiology, 167*(7), 875–881. <https://doi.org/10.1093/aje/kwm390>
- Meeks, L., Heit, P., & Page, R. (2013). *Comprehensive school health education: Totally awesome strategies for teaching health*. New York, NY: McGraw Hill.

- National Association for Sport and Physical Education (NASPE). (2010). *Active start: A statement of physical activity guidelines for children from birth to five* (2nd ed). Retrieved from: <http://www.aahperd.org/naspe/standards/nationalGuidelines/ActiveStart.cfm>
- Palmer, L. (2003). *Developmental brain stimulation in school and day care settings: SMART overview*. Winona, MN: Office of Accelerated Learning, Winona State University.
- Pate, R. R., Mitchell, J. A., Byun, W., & Dowda, M. (2011). Sedentary behaviour in youth. *British Journal of Sport Medicine*, 45(11), 906–913.
- Seger, M. (2015). *No sweat: How the simple science of motivation can bring you a lifetime of fitness*. New York, NY: AMACOM.
- Sibold, J., Edwards, E., Murray-Close, D., & Hudziak, J. (2015). Physical activity, sadness, and suicidality in bullied US adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, 54(10), 808–815.
- SPARK. (2016). *Early childhood teaching tips: Structured activity vs unstructured activity*. Retrieved from: <http://www.sparkpe.org/blog/structured-activity-unstructured-activity/>
- Stodden, D. F., & Goodway, J. D. (2007). The dynamic association between motor skill development and physical activity. *Journal of Physical Education, Recreation & Dance*, 78(8), 33.
- Syrad, H., Falconer, C., Cooke, L., Saxena, S., Kessel, A. S., Viner, R., ... Croker, H. (2015). 'Health and happiness is more important than weight': A qualitative investigation of the views of parents receiving written feedback on their child's weight as part of the national child measurement program. *Journal of Human Nutrition and Dietetics*, 28(1), 47–55.
- U.S. Department of Health and Human Services (DHHS). (2016). *Step it up! The surgeon general's call to action to promote walking and walkable communities*. Retrieved from: <http://www.surgeongeneral.gov/library/calls/walking-and-walkable-communities/exec-summary.html>
- Townsend, N., Wickramasinghe, K., Williams, J., Bhatnagar, P., & Rayner, M. (2015). *Physical activity statistics 2015*. British Heart Foundation: London.
- Vidoni, C., & Ignico, A. (2011). Promoting physical activity during early childhood. *Early Child Development and Care*, 181(9), 1261–1269.
- Wabitsch, M., Moss, A., & Kromeyer-Hauschild, K. (2014). Unexpected plateauing of childhood obesity rates in developed countries. *BMC Medicine*, 12(1), 1.
- Wang, Y., Beydoun, M. A., Liang, L., Caballero, B., & Kumanyika, S. K. (2008). Will all Americans become overweight or obese? Estimating the progression and cost of the US obesity epidemic. *Obesity*, 16(10), 2323–2330.
- Yoder-Wise, P. S. (2014). Sitting is the new smoking. *The Journal of Continuing Education in Nursing*, 45(12), 523–523.
- Zero to Three. (2016). National Center for Infants, Toddlers, and Families. *Early Experiences Matter*. Retrieved from: <http://www.zerotothree.org>

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# Chapter 2

## Fine Motor Skills, Executive Function, and Academic Achievement



Audrey C. Rule and Latisha L. Smith

### Part I: Motor Skills, Executive Function, and Academic Achievement

Attention is crucial to learning and academic achievement. In this chapter, we explore the connections between fine motor skills, academic achievement, and attention. First, we investigate the relationship between motor and cognitive development. This is followed by consideration of specific links between fine motor skills and achievement. Classroom-tested ways to improve fine motor writing skills in kindergarten are considered. Then, we review connections between executive function skills, which include attention, and achievement. Ways to improve executive function skills, including the use of fine motor skill activities, are discussed next. In the last part of the first half of the chapter, we examine how fine motor skills, executive function skills, and school achievement are fundamentally interrelated.

### Relationship Between Motor and Cognitive Development

More than a half-century ago, Piaget (1953) proposed that sensory and movement activities during the sensorimotor stage were important for the development of cognitive abilities. Several recent studies provide evidence for this assertion. One study (Bushnell & Boudreau, 1993) investigated the role that motor development might

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