Journal of Social Sciences and Humanities
Vol. 6, No. 3, 2020, pp. 166-173
http://www.aiscience.org/journal/jssh
ISSN: 2381-7763 (Print); ISSN: 2381-7771 (Online)

Literature Review of Early Childhood Physical Education Practices

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Abstract

Physical Education programs are designed to provide students with positive learning experiences, which can often contribute to social opportunities where children may interact with their peers. This paper provides a literature review of the following areas of early childhood education and development; dynamic systems theory, maximum and appropriate practice, preschool physical education, preschool movement experiences, play and play environments. Dynamic systems theory purports that systems are constantly undergoing changes due to the individuals physical development, the task at hand, and/or the environment one is exposed to. This theory supports the emphasis on maximum and appropriate practice within the education environment. Research suggested that practice conditions for all children, due to their diverse levels of motor abilities, should include maximum, appropriate practice which facilitates high levels of student success that leads to student learning. Preschool physical education classes should obtain structure but the typically rigid elementary class would not be developmentally appropriate for this age level. Similarly, early childhood classes should be structured to allow for a short *skill* introduction followed by play which may or may not directly include the skill taught. However, the classroom theme would be reinforced throughout all activities with in the classroom environment. Kinesthetic perception is especially integral due to its association with body awareness, spatial awareness, directional awareness, and temporal awareness. Children expand their knowledge base and tactical awareness through their sense of touch and object manipulation. Therefore, this review has been structured to discuss literature related to "best practices" in early childhood physical education as it links to play and dynamic systems theory.

Keywords

Dynamic Systems Theory, Play, Maximum Practice, Appropriate Practice, Preschool Physical Education, Preschool Movement Experiences, Play Environment, United States

Received: November 17, 2019 / Accepted: June 15, 2020 / Published online: July 7, 2020

1. Introduction

Physical education provides general movement opportunities and is thus a significant activity in which a child to engage. Children are oriented to basic locomotor, nonlocomotor, and manipulative skills. Physical Education programs are designed to provide students with positive learning experiences, which can often contribute to social opportunities where children interact with their peers. Through provision of select environmental opportunities to a child, an instructor can afford the child with a safe environment that will accelerate the emergence of gross motor skills. Positive experiences can provide the children with a sense of accomplishment. This paper provides a literature review of early childhood education and development as it pertains to; dynamic systems theory, maximum and appropriate practice, preschool physical education, preschool movement experiences, play and play environments.

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2. Dynamic Systems Theory

Dynamic systems developed as an applied branch of Bio-dynamics. Kugler, Kelso & Turvey [27] introduced dynamic systems theory as an emergence of motor behavior. This theory emphasized the dynamic and self-organizing properties of the motor system to individuals developing motor competencies. Change was believed to be stimulated by biological development, environment, and the demands of the specific task. Synergetics were discussed by Haken [20] as an attempt to establish principles governing a pattern generation that would be common to a variety of systems, though independent of the structure producing the behavior.

Historically, physical maturation has been defined as development of the central nervous system, development of muscular strength and endurance, development of posture and balance, as well as improvement in sensory processing [12]. Physical maturation has been related to the progressive pattern of physical development. Particular systems must be developed to a notable level to observe the onset of certain skill requirements. Specific systems advance earlier in some infants and children than in others, therefore the rate of appearance of the motor milestones varies [12].

Dynamic systems theory provides an understanding of movement and movement control as it emerges developmentally [12] Accordingly, "qualitative changes in motor behavior emerge out of naturally developing dynamic attributes of motor systems and coordinative structures" [12 p. 208-209]. In this regard, locomotor development was viewed as a consequence of the development of various body systems, the tasks to be undertaken, and the environmental context in which the task was done [29, 44, 45, 13, 22, 42, 14, 30]. Dynamic systems theory provided a comprehensive understanding of motor control and performance across the life span, which contrasted the maturation perspective. In accordance with the fundamental principles of dynamic systems theory, organisms were composed of a number of anatomical parts and physiological systems. The systems undergoing motor development are self-organizing. As the self-organizing properties of the body developed at different rates, movement emerged. This led to a movement pattern rising from the interaction of essential parts and not primarily through development of the central nervous system.

Motor development is complex and cooperative within an organism. The combining efforts of a number of body systems is required for movement. Components cooperate and interact in an infinite number of ways to produce a movement whose outward appearance remains relatively stable. Therefore the idea of motor programs and rigid reflexes is abandoned and movement is viewed as continuous and flexible. One assumption is that muscular forces and mechanical interactions determine movement. However, forces are limited by the intention of the movement as well as the speed of the movement, body position, length of body segments. The skeletal muscle system, posture to maintain positional balance, sensory and perception to detect environmental information, and the cardiovascular system to supply oxygen to the muscles must all cooperate to enact one simple movement.

The processes of a skill and component structure develop asynchronous and non-linearly. Dynamic Systems theory suggests that movement patterns progress through transitions and that disruptions occur in the process. The theory attempts to account for these characteristics from processes that are continuous. Two influences on development are environmental and biological factors. As the demands of specific tasks alter, the movement may change as a result. Once can detect discontinuous shifts from one qualitative behavior to another.

The task, environment and the individual are the three subsystems that are believed to be prevalent in accordance with dynamic systems theory. The subsystems are believed to operate separately and in unity to determine the rate, sequence, and extent of development. The result of a number of the subsystems working dynamically together in a cooperative manner is the coordination and control of movement. The subsystems are believed to be equal, and collaboratively cause motor behavior to evolve. Resulting in preferred patterns of movement that develop in response to particular factors within the individual, task, and environment. The developing patterns are preferred because they require the least amount of energy.

A number of variables provide a condition for a pattern change. The factors within subsystems of the task, individual, and environment interact and as one gains motor control and movement competence, the factors have potential for modifying and being modified by the other. The theory proports that one factor can be primarily responsible for a systems developmental change or the emergence of a new subsystem can make another disappear. For example there may be a decrease or disappearance of the stepping rate when an infant matures and gains weight. In this example, the weight-gain factor is believed to be the control parameter as additional strength would be needed to demonstrate the stepping rate. Conversely, when the same infant is introduced to a water environment the stepping rate often reappears due to the elimination of gravity that reduces the strength needed to perform the locomotor behavior.

The rate-controlling factors for walking were muscle strength in the trunk and leg extensor muscles to allow the infant to maintain an upright posture on a small base of support, and

the development of balance to the point that the infant can compensate for a shift of weight from one leg to the other [47]. The characteristics of infants' early walking are consistent with this suggestion. Early walking is characterized by a short stride, a flat-footed step, little coordinated arm action, and more variable timing between the two legs [7, 9, 43]. One consistency, with all of these factors, is adequate strength and dynamic balance. Children who are new to walking, demonstrate a more adult-like timing of their steps when adults hold their hands as they walk, thus assisting their strength and balance [9]. In this regard, the onset of locomotor milestones are consequential of the development of many systems. Contrary to maturation theory, the nervous system has not been deemed to be the sole rate-controlling system in dynamic systems theory as body systems do not develop together or at the same rate. In fact, some body systems are deemed rate-controllers for a particular skill and thus the rate of development of individual systems affects and controls an individual's rate of development for a particular skill. Therefore, different systems are noted to be rate-controllers for different skills. Consideration of multiple systems provides the opportunity to identify which of the many systems are important to the onset of new skills. Although many of the body's systems may have developed to the point where a new skill is possible, if one or more other systems are slower in developing, then the new behavior cannot start until these slower developing systems reach a critical point. These limiting systems would be the rate controllers or rate limiters for the new skill. Maturationists always consider the nervous system to be the rate controller. However, many systems must be considered when determining the rate-controlling factors in development.

According to dynamic systems theory developmental change is nonlinear and discontinuous. "A dynamic system is an *open system*, meaning that it is continually exchanging information with its surrounding environment, and through those interactions, breaking down and building up new forms and organizational patterns" [29]. Motoric change over time is individual and is not necessarily smooth and hierarchical, nor does it necessarily involve moving toward higher levels of complexity and competence in the motor system. A variety of factors within a system influence the discontinuous manner in which individual development occurs and the continuous changes happen over time. Dynamic Systems "theory pays significant attention to *variability* and change, treating small fluctuations in development as potentially informative data" [29, p. 3]. Skill performance qualitative changes can be discontinuous even though a factor continuously increased or a movement to a less proficient pattern of movement may decline due to the reorganization of systems.

Spontaneous arm movements of three-to-five year old infants exhibited patterning similar to the reaching movements at five months [25]. The authors contend that spontaneous movements are organized and important for perceptual-motor development. The process of learning to control spontaneous movements and make them purposefully directed is motor development. Fourteen-month-old toddlers and 8.5 month old crawling infants were encouraged to ascend and descend sloping walkways [1]. The toddler and crawler groups over-estimated the children's abilities to ascend. The toddlers switched to a sliding position for safe descent on the descending trials; and crawlers kept going experiencing many falls. During descent, the toddlers were more apprehensive and attempted locomotor modifications while the crawlers were only slightly hesitant with the 30 degree and 40 degree slopes and the alternate descent positions were never explored. According to the findings, children must learn to perceive affordances for locomotion over slopes, and that the fine-tuning of exploratory activity may result in learning a new skill.

Infant limb movements were observed while placed in an infant bouncer, during a longitudinal study on eight infants [19]. During observation, the infants were experimenting with different musculoskeletal organizations and the physical properties of their moving bodies It was determined that the organizing action patterns emerged from spontaneous activity in relation to the constraints of the task as the infants explored. The experimenting process was deemed to be essential to self-organization of task-specific behavioral patterns and as the system evolved a stable, preferred, action pattern was exhibited. In accordance with dynamic systems theory, systems constantly undergo changes due to the task, individual and/or environment. An emphasis on children's maximum and appropriate practice within the education environment is supported by Dynamic Systems Theory.

3. Practice

Motor development is age-related not age-specific therefore children have diverse levels of motor ability. Due to this, practice conditions for all children should include maximum, appropriate practice which facilitates high levels of student success that leads to student learning [17, 34, 40, 18] The "ability of teachers to increase pupils' time-on-task at the appropriate level of difficulty and within the confines of pupils' abilities and context areas, can only enhance learning opportunities" [21, p. 30]. The amount and quality of appropriate practice relate positively to skill achievement. Numerous studies have found that learning occurred when students were engaged in successful appropriate practice [17,

40].

Studies indicated that performance standards should be established for every level of skill, due to the students' varying abilities. The physical education classroom should promote a rate of progression that correlates with the children's individual natural abilities. Teachers should pre-test and observe student practice, evaluate students' skills regarding their individual improvement, and then plan subsequent practice sequences according to the information derived from teacher observation [34]. Research suggested that inappropriate practice and lack of practice variation hinder student skill acquisition. In a study which compared the effectiveness of practice progressions the authors stated that practice sessions should be sequenced in progressive levels of difficulty appropriate for the learners [11]. It was suggested that complex motor skills need to be broken down to provide for skill progression in order to meet individual student learning styles as well as to provide for appropriate practice [11]. Opportunities for appropriate practice will provide for numerous successful student engagement opportunities. Children's opportunities to successfully respond to numerous physical opportunities has been proven to promote student learning in the physical activity class [11].

Preschool physical education classes should obtain structure but the typically rigid elementary class would not be developmentally appropriate. In this regard, early childhood classes should not resemble a watered down elementary physical education class. Preschool physical education classes should be structured to allow for a short *skill* introduction followed by play which may or may not directly include the skill taught. The opportunities for play provide the child time to either experiment with the skill or to disengage from the newly introduced skill. However, the classroom theme would be reinforced throughout all activities with in the classroom environment. The ideal preschool physical education structure will be discussed below.

4. Physical Education in Preschool

Historically, early childhood educational programs have seldom included motor skill instruction [26]. However, the most effective way for primary-aged children to learn is through physical modalities [32, 37]. According to the National Association for the Education of Young Children (NAEYC), the U.S. Department of Health and Human Services, and the Society of Health and Physical Educators (SHAPE) America children enrolled in preschool programs should receive physical education instruction. There is evidence which suggests "that school physical education programs for young children can have a significant, positive effect on children's fundamental motor skill performances, and health related issues" [26, p. 28].

Only a few preschool physical education curriculums exist, but all maintain some of the same characteristics. These characteristics are also labeled *best practices* by early childhood physical educators. "A well-defined program for large muscle development (or motor development) addresses three major categories; fundamental movement skills, physical fitness, and perceptual-motor development" [31, p. 4]. Regrettably, "children who have not learned to perform isolated fundamental movement skills often experience frustration and failure when they are enrolled in sport or dance classes that require the performance of complex combinations of movement skills" [31, p. 5]. An individual's perception of physical activity may be based upon these early failure experiences, which in turn may result in sedentary adulthood.

Children who attend public preschools are often less physically and motorically fit than children who experience home care. "Recent research reveals that many young children have not developed their perceptual-motor skills, especially in the area of visual awareness, auditory awareness, and time awareness" [31, p. 6]. This is especially true within preschool environments. "Research has shown that most children do not receive enough fitness-enhancing activity during play experiences to develop an adequate level of fitness or motor skill development" [31]. Developing fundamental motor movements and the introduction of healthy exercise habits in the early years should develop a structure upon which future physical participation success is built. Due to a low fitness level, children who attend day care may find a decreased future participation in physical education in comparison with their peers in home care.

Developmentally appropriate preschool physical education will include; teaching children versus teaching activities, utilizing integrated learning activities and curricular themes, as well as active learning experiences [2]. Constructing a physical education curriculum based on age is contrary to Dynamic Systems Theory, since motor development is age-related but not age-dependent [3, p. 106]. Therefore, planned preschool physical education experiences should be structured differently than traditional elementary experiences. Minimally, preschoolers should not be expected to maintain focus on the same topic for extend periods of time. After a brief introduction students should be provided with numerous opportunities to experience the activity, or to return to the activity at a later time.

In order to accommodate the diverse developmental needs of the preschoolers, physical education experiences should

include the following four guidelines for developmentally appropriate physical education equipment; offer children several pieces of equipment which have the same form, but vary in size, allow children to self-select equipment, use equipment that children may themselves change to accommodate their own unique developmental levels, build evaluation devices into equipment that encourage children to realistically assess (their)…performance [23, p. 73].

A key role for preschool teachers is to structure a purposefully interactive learning environment. The structure should enhance children's interaction with each other and the environment. Ideally physical educators and early childhood teachers should work together to develop an environment that integrates movement experiences within the preschool classroom.

4.1. Movement Experiences in Preschool

In accordance with developmentally appropriate practice, the preschool curriculum will include numerous play opportunities. "Planned movement experiences lay the foundation for the development of physical skills which are refined during less structured, yet active, play experiences" [2, p. 38]. Likewise, "the experiences that children have during their play activities adapt their body to develop and progress motor skills" [3, p. 106]. Development of one's perceptual-motor system may occur due to planned preschool movement experiences. "All motor tasks require the use of sensory information and perceptual mechanisms" [13, p. 66]. The five basic senses of sight, hearing, touch, smell and taste serve as guides to children's learning. As kinesthetic perception is association with body awareness, spatial awareness, directional awareness, and temporal awareness, it is especially integral. Children's tactical awareness expands their knowledge base through their sense of touch and object manipulation.

The size, strength, and endurance characteristics of preschool children vary greatly. "The typical preschooler increases in height and weight, loses limb and body fat, lays down muscle tissue, develops added neuromuscular control, and changes body proportions rapidly" [23, p. 15]. When planning movement experiences for this age group these differing factors must be taken into consideration. "By using the exploration approach, children can engage in an individual program of motor skill development at the appropriate level of difficulty" [16, p. 60]. Implementing an individual approach allows children to self-select developmentally appropriate equipment as not all will be successful with equipment of the same size, weight, speed and texture. The individual approach allows children to experiment with a variety of equipment. Additionally this will lead the children to optimally learn more about their own body and its individual movement possibilities.

Although free play is important for preschooler development, free play experiences are not enough. Planned movement experiences should be integrated into the early childhood curriculum. "Planned movement experiences ensure that sensitive periods for acquiring motor skills are not neglected" [23, p. 15]. Educators must keep in mind the varied developmental levels of preschool children and consciously plan opportunities that embrace all levels. "Motor skill acquisition in early childhood is a fairly orderly and sequential process influenced by both maturation and experience" [23, p. 15]. A developmentally appropriate physical education preschool program will structure the tasks and learning environment to assist all children to develop optimally.

An emphasis on motor skill development is crucial to children during the early childhood years. "Experiences should involve locomotor, nonlocomotor, and manipulative skills, in addition to the development of knowledge of movement concepts included in the categories of space awareness, effort, and relationships" [2, p. 39]. In order to develop a movement base upon which elementary physical education builds, these experiences are integral to typical development. Along these lines, "physical activities for young children are intended to set the foundation for achieving skills and fitness related to their general health and ability to participate in a variety of personal activities" [16, p. 57]. The desultory movement experiences can be strengthened throughout unplanned play experiences.

4.2. Preschool Physical Activity

There are numerous criteria for determining what is and what is not play. Research studies have devised separate lists of what exactly constitutes play, however there are similar criteria found across each. Researchers agree that true play erupts and is maintained by internally motivated factors [36, 28, 41]. They also agree that play is not goal oriented and focuses on the ability to suspend reality. Play is determined due to the goals, materials, rules, and other elements used in play activity [28]. Garvey would add that an activity must be spontaneous and voluntary as well as involve active participation before being defined as play [15].

Currently, preschool curriculum focuses on structured activity. However, the virtues of play are once again begin heralded. Play in the preschool environment allows the students to experiment with themselves, peers, and the equipment. In reference to play and physical activity, preschool children, when placed in environments containing various kinds of equipment, and who are surrounded by an emotionally supportive staff, usually engage in high levels of

productive physical activity, reflective of promoting social, emotional, and intellectual growth" [8, p. 43]. If the preschool environment is contained and offers a degree of safety, children tend to be more at ease and exploratory in the environment.

Play is important because it "offers a chance to develop efficacy because children can repeat movements until they master them" [10, p. 62]. Play environments are quite relaxed and thus may provide preschoolers the relaxed atmosphere they require in order to engage in a new activity. Since the activity is self-determined play, it allows the child to engage in the activity at a level they deem suitable. The activity risk is instantaneously removed, or at least essentially negated, due to the play context. By defining an activity as play, the child may be able to make a task more or less ambiguous to meet their intent. Only the individual child can determine what is appropriate when engaged in a play task.

Preschool educators regularly structure purposeful play environments with the intent to meet specific objectives. However, these planned actions are contrary to the definition of play addressed above. Often a stimulus may initiate a play activity. It is important that numerous stimuli are available in the play environment. "Stimulation appears to be a factor in the rate at which motor skills are learned [16, p. 58]. When planning for preschool physical education instruction, educators are urged to remember the role of stimulation and excitement.

4.3. Indoor and Outdoor Play

The environmental context of indoor and outdoor play can assist with encouraging and sustaining children's play. "Children play because play is their natural form of expression and their natural way to learn things, while physical development is itself a natural result of the activities children become involved in through play" [4, p. 457]. "Play is low quality and often becomes destructive when the same activities and materials/equipment are offered day after day" [39, p. 33]. When children outgrow the intended purpose of equipment, they will naturally increase the challenge equipment provides by implementing other envisioned uses.

Indoor and outdoor play environments are conducive to different types of play. "Outside play allows for more active play with fewer restrictions on noise and movement, and greater freedom with natural materials like water, sand, snow, and soil" [39, p. 31]. Similarly, research findings indicate that large spaces increase social interaction and rough-and-tumble play while smaller spaces promote solitary play [6, 48]. Larger play environments support freedom of movement for preschoolers. Additionally, the play environment must feel safe enough to reduce the risk of play by encouraging active play. "The play environment for preschool children can be conceived of as a linked series, encouraging and directing transference of interest from one thing or place to another" [49, p. 298]. Thematic units can encourage implementation of play across environments.

Developmentally appropriate preschool play environments permit opportunities for free play. Specifically, the preschool physical education environment should be "structured to provide an opportunity for them to examine, explore, and investigate their world" [38, p. 34]. The physical education literature advocates for maximum participation of students. The optimal arrangement of the physical environment would promote student maximum engagement [33]. The typically confined preschool environment and lack of equipment may minimize opportunities for meaningful preschool movement experiences.

5. Conclusion

During the preschool years, individual rates of development vary greatly. According to dynamic systems theory, motor skills are not innate non-varying structures but instead individual systems. Therefore, the individual's development, task at hand, and the environment all play an integral part in the occurrence of movement. Physical educators have long endorsed implementing maximum developmentally appropriate practice opportunities for children. In this regard, developmentally appropriate preschool physical education practice opportunities allow for student choice of task and equipment. After a brief *skill* introduction, students should be encouraged to engage in unstructured play and explore the task and their own abilities. Implementation of the play context will reduce the risk associated with a new activity and permit individual interpretation and exploration of movement.

Training preschool teachers in physical activity and the motor development of children is imperative. "Teachers in training should study a program of physical development as part of the early learning curriculum: motor activities for young children with basic motor learning content activities, teaching strategies, environmental conditions, and evaluative measures for working with young children through a movement and play medium should be included" [10, p. 62]. This training would provide teachers with the knowledge and experiences to optimally integrate physical activity into the preschool curriculum. Teacher training should encompass evaluation of student motoric skills. Pretesting students physical development at the start of the year and implementation of ongoing criterion and performance based assessments will guide teachers to ensure the environment

provides developmentally appropriate challenges. The assessments should be used to structure future activities. In accordance with developmentally appropriate practice, the activities should focus on educating the whole child and be theme oriented.

The physical development of preschoolers relates directly to the complexities of dynamic systems theory. Children's social and emotional development can be enhanced with engagement in developmentally appropriate physical activity. It is purported that early movement successes may serve as the catalyst for engagement in lifelong physical activity. Ensuring preschool teachers receive substantial training in physical activity and motor development is imperative. The preschool curriculum should be revised to ensure a high amount of planned and developmentally appropriate physical activity followed by opportunities for free play. Revising the preschool curriculum to align with the best practices addressed in this paper may lead to children's optimal development and success in school.

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