Peer Reviewed Article

Systematic Adaptations for Students who are Deafblind

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ABSTRACT

Part of an adapted physical educators' responsibility is to provide successful adaptations and if needed, provide an alternative physical activity to meet the unique needs of students with disabilities. Due to the low incidence of students who are deafblind, providing proper adaptations and alternative physical activities may be challenging. To assist with the examination of proper adaptations the Dynamic System Theory and Newell's Model can be utilized. A systematic approach to make adaptation to physical activities can lead to an increase in participation, skill development, and independence. Adapted physical educators can increase the probability that appropriate motor and physical activities are presented to a student who is deafblind by examining the individual, environment, and task constraints.

Introduction

There is a significant need for information, resources, and research in the field of deafblindness pertaining to adapted physical education in order to facilitate successful inclusion (Lieberman, Ponchillia, & Ponchillia, 2013). Over 61% of school aged children with deafblindness are being educated a portion of their day in a regular classroom [National Center on Deaf-Blindness (NCDB), 2017]. With the increase in inclusion, adapted physical educators need to be prepared to include students with deafblindness in physical education and must have the attitude, knowledge, and skills needed to meet their educational needs.

Educational techniques and interventions within special education are individualized and specifically designed, which may include adaptations when appropriate to the content, methodology, or delivery of instruction [Individuals with Disabilities Education Improvement Act (IDEIA), 2004]. Appropriate instructional strategies are critical components in the success and participation of a child who is deafblind (Hartshorne, Hefner, Davenport, & Thelin, 2011).

Highly qualified adapted physical educators can design, implement, and evaluate motor skills, and levels of fitness of students with disabilities; especially from low incidence populations including deafblindness (Anderson & Smith, 2013; Regan & McElwee, 2013). However, most adapted physical educators have little or no knowledge and no previous training related to teaching students with deafblindness (Lieberman, Haibach, & Schedlin, 2012). Many adapted physical educators also lack knowledge in how to develop appropriate programs for students who are deafblind (Lieberman & MacVicar, 2003).

Deafblindness

A total of 9,635 individuals, birth through 21 years old, were included in the national child count of youth who are deafblind (NCDB, 2017). Many of these children are provided early intervention and special educational services under IDEIA, (2004). Under this Act:

> Deaf-blindness means concomitant hearing and visual impairments, the combination of which causes such severe communication and other developmental and educational needs that they cannot be accommodated in special education programs solely for children with deafness or children with blindness [34 C.F.R. §300.8(c)(2)].

Due to the concomitant loss in hearing and vision, it is imperative that individualized programs and instruction are provided to improve overall development (Muller, 2006).

In addition, 90% of this population has one or more additional disabilities, with approximately 43% having four or more additional disabilities (NCDB, 2017). Some children may experience additional physical or cognitive disabilities, complex medical needs, and/or behavior challenges. Consequently, children with deafblindness are a vastly heterogeneous low incidence disability population and at times are misunderstood due to the nature and extent of their diverse characteristics (McCormick, 2015; Schalock, 2016).

Dynamic Systems Theory and Newell's Model of Motor Development

The Dynamic Systems Theory (DST) is an ecological perspective of motor development, which emphasizes that movement tasks are controlled and produced by interactions of the individual's body subsystems (i.e., vision, hearing, muscular, skeletal) and the environment (Smith & Thelen, 1993; Thelen & Ulrich, 1991). Karl Newell developed a model of constraints based off of interactions occurring within an organism causing movement to occur (Newell, 1986). The process of motor development is connected to changes within the individual, environment, and task (Newell, 1984, 1986; Thelen & Smith, 1996, see Figure 1). The individual's body subsystems are in constant self-organization in order to adapt to change as different patterns of movement are acquired (Kamm, Thelen, & Jensen, 1990). As the process of motor development occurs, the subsystems of the body must reorganize due to new behavioral change, known as motor learning.

The dynamic system approach describes the concept of constraints as potential rate limiters or affordances. A rate limiter "is an individual constraint or system that hold[s] back or slows the emergence of a motor skill" (Haywood & Getchell, 2009, p. 23). Affordances are a person's capabilities based on the movement possibility related to the task and the environment (Gibson, 1977). Affordances tend to promote and encourage developmental change.

Based on the DST, each subsystem is interdependent with other subsystems, which contribute to the attainment or delay of motor skills. The influence of individual constraints is one major aspect of the DST. Impairments to specific body subsystems (i.e., vision, hearing) may act as rate limiters for specific motor skills (Kamm et al., 1990; Thelen, 1998). Although vision and hearing are usually not totally absent, the degree of loss can greatly impact other subsystems concurrently impacting motor development.

Children with deafblindness need educators who are trained with specialized skills and interventions to meet their needs. Adapted physical educators need to be knowledgeable of the adaptations and interventions needed to develop a specially designed educational program in their least restrictive environment. Newell's model and the DST can be applied to understand student's constraints and to systematically establish appropriate adaptations and activities to promote development and increased skill performance.

Systematic Adaptations

Let's examine C.J., a 3rd grade student who is new to his elementary school. C.J. loves to be active

and included with his peers. C.J has Usher Syndrome, which is an inherited condition that affects both hearing and vision. Vision loss is typically due to retinitis pigmentosa, which is a loss of peripheral vision causing tunnel vision (National Institute on Deafness and Other Communication Disorders, 2008). The adapted physical educator has never had a student with Usher Syndrome or deafblindness. In order to develop his IEP and what adaptations he may need, the adapted physical educator will perform appropriate evaluation through assessments and examine the three constraints (i.e., individual, environment, and task; see Table 1).

Individual Constraints.

The first essential component of Newell's Model and the DST that an adapted physical educator needs to be aware of is his/her individual constraints. Individual constraints involve both the student's structural and functional constraints. The student's structural constraints (i.e., body structures) provide information on how a student's body performs; it may include how he or she may ambulate or their ability to see and hear. Gaining information about the student's structural performance is important. For students who are deafblind, such as C.J., the adapted physical educator needs to learn about C.J.'s visual acuity (i.e., clarity, 20/20) and field of vision as well as his hearing.

The adapted physical educator started by collaborating with other professionals who are a part of C.J.'s team and are experts within their field. The adapted physical educator can consult with C.J.'s certified teacher of the blind or visually impaired and certified teacher of the deaf or hard of hearing to learn more about C.J.'s vision and hearing. In addition, reviewing the student's IEP and cumulative folder can provide additional information, such as a functional vision assessment or audiology report.

In this example, the adapted physical educator gained knowledge that C.J. has 50 degrees of peripheral vision loss. His visual acuity, corrected with glasses, is 20/70, meaning with normal acuity what a person sees at 70 feet, C.J. is able to see at 20 feet. The teacher of the deaf or hard of hearing reviewed his audiology report. C.J. has profound hearing loss and communicates through American Sign Language and at times through tactile sign language. This knowledge will assist with environmental adaptations needed to instruct C.J. He may need preferential seating in squads and he will have an interpreter or intervenor to provide him communication access. Adapted physical educators must also be aware of any contraindications that a student may have due to their disability or equipment. For example, hearing aids and cochlear implants should be removed before any aquatic activities.

The student's functional constraints include specific individual characteristics such as: strength, endurance, flexibility, confidence, fear, communication, socialization skills, and level of independence within a physical education environment. A student's interest level and attention should also be observed and noted. This information can be gathered through a student's IEP and assessment results. Observations of the student in both structured and unstructured environments can also be valuable, in addition to motor skill and fitness assessment results.

Additional information can be acquired through speaking with the student's teacher, parents, nurse, physical therapist, occupational therapist, and other service providers. All educators need to work in collaboration to create the optimal learning environment. One of the barriers to include students with deafblindness in physical education is the lack of knowledge about the student's educational needs (Lieberman & Houston-Wilson, 1999). Therefore, it is imperative to obtain information about the individual, both structurally and functionally.

C.J.'s adapted physical educator contacts his previous adapted physical educator to learn more about his functional constraints. The adapted physical educator learns that C.J. loves to be physically active and social but becomes frustrated

easily when his peers and teachers do not understand him. An adaptation would be to provide him with multiple means of communicating (i.e., paper and pen, iPad, sign language). C.J. is highly motivated by praise and enjoys being able to perform activities independently or with a peer. C.J. is interested in sports but tends to have a short attention during instructions and learns best through visual demonstrations. Making sure C.J. is familiar with the equipment and environment prior to participating in a skill or activity will increase his understanding of the task and his willingness to participate. Therefore, providing pre-teaching prior to a new unit would be very beneficial. After gaining this information, additional environmental adaptations should be examined. Due to the interconnectedness of constraints, changes to one constraint can alter another constraint.

Environmental Constraints

The second component is environmental constraints, which includes the surroundings, location, lighting, noise level, number of participants involved, surface (i.e., hard, grass, rough etc.), and the setting of the skill, whether in an open or closed environment. Reexamining the student's individual constraints, can provide information on what environmental adaptations may be needed.

Due to the changing environment in physical education, the student must be able to adjust their skill and combine skills to be successful in open environments (Moran, 2012). Therefore, providing the opportunity to perform a skill in a closed environment may increase participation and confidence. An adaptation to perform the skill independently first, then add in additional participants can increase skill success.

In addition, access to information whether through visual, auditory, or physical modalities may need to be adjusted to meet the student's constraints. Students who are deafblind may miss information due to their decreased access to the environment and the teacher. Their access to information is necessary for learning, communicating, and overall development. Instead of effortlessly receiving information they must work to attend, gather, and interpret the information (Alsop et al., 2012).

Interpreters or interveners, can assist in providing access to information. A sign language interpreter will change spoken English into American Sign Language. An intervener is a paraprofessional who has specialized training in deafblindness and works with the student by providing them access to their environment by their preferred means of communication (Alsop et al., 2012). Some students who are deafblind may also utilize assistive devices for communication. These devices should be brought and utilized in their physical education environment and if needed, training should occur.

Furthermore, the lighting within the environment may also affect a student's vision. C.J.'s vision is affected by the amount of light and position of the light. Direct light behind the instructor will make it difficult for C.J to see; also, poor lighting conditions will decrease C.J.'s vision. Therefore, the teacher may need to reposition where they stand. Instruction may need to occur in a shaded area compared to direct sunlight. C.J. also learns best through visual cues and demonstrations. Due to the degree of his hearing loss, information should be presented visually within his field of vision. Large picture cue cards and video demonstrations can provide vital information to the student; in addition to learning basic signs to incorporate during class.

Task Constraints

The third essential component is task constraints. This area can be easily manipulated by an adapted physical educator. Based on the individual and environmental constraints, the task may need to be modified to allow the student to experience successful skill performance. Performing a task analysis can provide valuable information on modifications needed for the student to increase their skill level (Menear & Davis, 2007).

Task constraints include the type of equipment being used within the activity. In addition, the dimensions or distances within an activity may need to be adapted. The rules of a particular activity along with the performance of a discrete or a continuous movement are task constraints. Furthermore, the relationships (i.e., individual, partner, or group) within the task can be

a constraint. For some students, pre-teaching of a skill or activity may need to be performed before class participation (Lieberman et al., 2013).

For instance, C.J has difficulty continuously performing a manipulation skill due to his visual impairment. He tends to lose track of the equipment. Providing an adaptation of string or rope attached to the equipment (i.e., wiffle ball) can increase his independence and opportunities to practice. The rope allows him to independently bring the ball back to continue practicing the skill. This will also decrease his level of frustration, when trying to search and find his ball.

He also prefers high contrasting colored equipment, which allows him to see the equipment easier in the gymnasium or outside, such as kicking a yellow ball on black pavement. Due to C.J.'s tunnel vision, equipment and students are not seen until they are in his central vision. Activities where balls are being thrown around quickly in various, unplanned directions, may not be a safe environment for C.J. In addition, chasing and fleeing games without proper modifications or assistance may be unsafe due to the chance of collisions. Providing a trained peer as a sighted guide would be helpful, along with slowing the pace of the activity. When analyzing student centered constraints, the players, game or activity, playing object, and the area or environment, should be considered as part of the systematic process of adaptation (see Table 2).

Conclusion

Children with deafblindness have fewer opportunities to participate in physical activities, are overall less active than their peers, and have motor skill delays (Lieberman & Houston-Wilson, 1999; Sherrill, 2004). Each student will have their own set of constraints; applying this systematic way to provide adaptations will increase participation and accessible opportunities to participate.

Development of fundamental motor skills at an early age provides students with confidence and abilities to perform many activities (Davids, Chow, & Shuttleworth, 2005). As a student increases their skill level and independence, the adaptations and assistance should fade out due to the change in their constraints. Therefore, their individualized program should be altered to meet their new functional level. It is vital that students with deafblindness engage in physical activities, physical fitness, and physical education during their school years. These students need leisure activities as part of their daily living to insure a high quality of life (Block, Taliaferro & Moran, 2013). Examining constraints within Newell's Model and the DST can encourage movement performance. Systematically providing adaptations to the environment and task based on the student's individual constraints can provide increased participation, success, and the correct physical and motor movement to occur.

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Table 1

Examples of Constraints to Consider in Physical Education

Individual	Environment	Task
Ambulation	Surface	Rules
Body structure	Surroundings	Movement type
Sensory limitations/ needs	Type of information presented	Type of equipment
Endurance	Distance	Relationships
Strength	Temperature	Experience level
Flexibility	Lighting	Purpose
Motivation	Layout	Quantity/quality
Independence	# of players	Responsibilities
Socialization	Amount of equipment	Prior skills needed

Table 2

Examples of Adaptations in Physical Education Based on Constraints

Players	Playing Object	Game/Activity	Playing Area/ Environment
Change the role of the players	Bigger or smaller	Change the rules of the game	Make the area larger or smaller
Limit or add responsibility	Softer or harder	Reduce repetitions or slow the pace	Make visible boundaries
Modify demands on the student	Audible or bright in color (i.e., contrast)	Decrease time of activity or add rest periods	Lower the height of goals
Decrease competition	Change the texture	Increase chances	Enlarge the width of goals
Decrease or increase the amount of players	Heavier or lighter	Change the relationships	Orient the individual to the area
Provide a peer to assist	Increase the size of the target	Add guidance or a leader	Outside or inside
Use pennies/colors to justify team members	Use multiple objects	Increase the tactile cues	Change surface area
Allow selection of positions	Allow selection of equipment	Change the objective of the game	Adjust external stimuli

Modified from: Morris & Stiehl, 1999

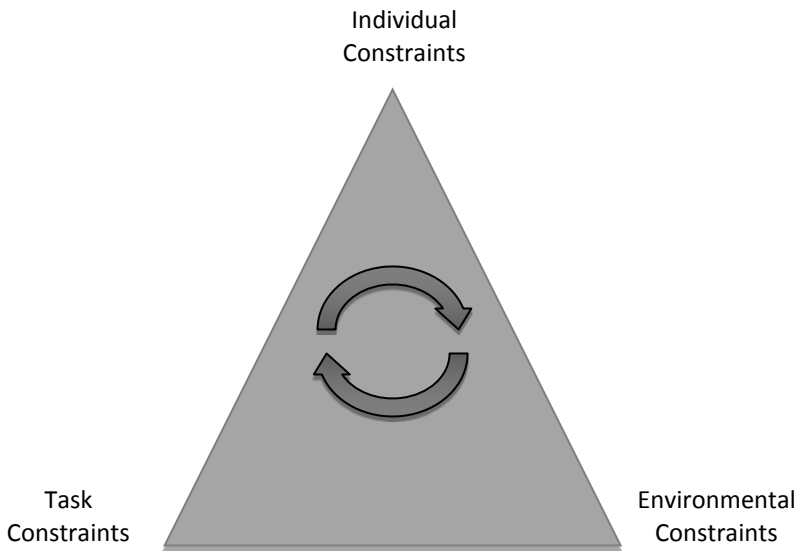

Figure 1: Newell's model of constraints (Adapted from Newell, 1986).