

Physical Education for Children *with Visual Impairment or Blindness*

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There are over 61,000 school-age children with visual impairments in public schools today. Research has shown that they are often behind their peers in physical activity participation (Augestad & Jiang, 2015; Haegele & Porretta, 2015; Lieberman, Byrne, Mattern, Watt, & Fernandez-Vivo, 2010) and in motor skills (Brian, Haegel, & Bostick, 2016; Haegele, Brian, & Goodway, 2015; Haibach, Wagner, & Lieberman, 2014; Wagner, Haibach, & Lieberman, 2013). In order for children with visual impairments to become physically active and self-determined adults, they must be provided the same opportunities as their same-age peers with the support necessary to ensure full access to the physical education curriculum (Haegele, Zhu, & Davis, 2017; Lieberman, Ponchillia, & Ponchillia, 2013).

Recent research has shown that physical educators perceive children with visual impairments to be one of the most difficult populations to include in general physical education (Lirgg, Gorman, Merrie, & Shewmake, 2017). In addition, these students experience numerous barriers to physical activity in recreation and personal fitness programs outside of the school setting (Perkins, Columba, Lieberman, & Bailey, 2013). The fact is that children with a visual impairments have the potential to perform equally as well or better than their same-age peers when provided with equal opportunity and encouragement. In the 2016 Paralympics in Rio de Janeiro, Brazil, four runners with visual impairments

Imagine you are 10 years old and by nature you enjoy physical activity and sports. Now add in that you are blind, and your PE class is completing a floor hockey unit that is set up in a way that does not allow you to play. This was a regular occurrence for me throughout my elementary PE years. I was rarely put in the game because there were no adaptations made that would have allowed me to participate. Instead, I was told to practice passing with a playground-sized ball that had bells in it, in the PE teacher's office adjacent to the gym. Students from my class would take turns playing with me. This became boring for me, but my alternative was to sit in the bleachers and "help" keep the score of the game my classmates were playing.

My other most vivid memory of elementary physical education is of playing "knockout." To this day, I do not remember the rules or details of the drill. I only remember being one of the first kids out of the game and hoping I would not get hit in the head with the ball. There were no bells in the ball, and I had no reference for where it was in space. There was the occasional stop of the game, so I could attempt to make a basket. I made a few baskets, but I attribute this all to chance since I had no idea where the basket was located. PE class improved slightly as I entered middle school; my seventh-grade PE teacher let me teach my class how to play goalball. My classmates seemed to appreciate and enjoy the sport. It was in that class that I really learned the importance of PE. Unfortunately, the quality of my PE class experiences went back down during eighth grade and high school.

— Lindsay Ball, college student with low vision and 2014 Paralympic skier

ran the 1,500 *faster* than the Olympic runners. This is only possible if educators create an environment of opportunity and high expectations.

Since physical educators often report challenges in this area, the purpose of this article is to provide some basic strategies for the inclusion of children with visual impairments in general physical education so that they can meet the national and state standards for physical education and make progress toward full participation and self-determination in society.

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Who Are the Children with Visual Impairments?

According to the Individuals with Disabilities Education Act (2004), “visual impairment, including blindness, refers to a decrease in vision that, even when corrected, adversely affects a child’s educational performance. The term includes both partial sight and blindness” (IDEA, 2004, sec. 300.8). Physical educators will encounter children with a range of visual abilities; some will not see any light, shadow or colors; some may be able to see equipment that is a color contrasted from its background; some may see large print; and some may be able to see enough to travel in familiar areas, such as jogging around a track but not be able to see small balls moving at a fast rate. Some words and phrases for educators to become familiar with are: blind, congenital visual

impairment, acquired/adventitious visual impairment, progressive vision loss, acuity loss, field loss, photophobia, and tunnel vision. See Table 1 for additional useful terms to know in discussing visual impairment, as defined by Cassin and Rubin (2012).

Educators should also know a bit about the background or cause of the visual impairment, as it may provide them with secondary information about what a student with that visual impairment might need. Some pathologies are linked with secondary conditions that may require further adaptations to the physical education environment. For example, albinism is caused by a lack of pigmentation in the skin, and students with albinism (who, as a result of the condition, also suffer from visual impairment) have the additional need for skin protection in the sun. Cortical visual impairment is often caused by other disabilities, such as cerebral palsy or traumatic brain injury, that may come with other adaptation needs. The proactive teacher will check with the teacher of the visually impaired (TVI) and the parents to determine any contraindications for physical education.

Accommodations and Modifications for the Inclusive Physical Education Class

Physical education teachers usually do not have a background or previous experience in making accommodations or modifications for students with visual impairments (Perkins et al., 2013). The fact is that physical education teachers typically have only one adapted physical education class during their undergraduate education program, and they spend less than two hours learning about students with visual impairments and accommodations for them. They do not learn enough of what they need to know in order to include these students in their general physical education classes (Conroy, 2012; Lieberman et al., 2013). When making any type of adaptation, the first person the teacher should talk to is the child (De Schipper, Lieberman, & Moody, 2017). Giving the child an overview of an upcoming unit of instruction and what will be taught, including the rules, equipment and instructions, can help the child brainstorm with the teacher about possible modifications. It is perfectly fine to seek help and support from parents and other professionals when researching appropriate strategies to include children with visual impairments in physical education. Typically, physical educators will collaborate with these other colleagues who work with the student:

- Teacher of the visually impaired: provides direct and/or consultative support for students and teachers to assist the student in accessing the curriculum, especially in the areas of alternate text formats, instruction in the expanded core curriculum, and adapted materials.
- Certified orientation and mobility instructor: a related service provider who assists the student in learning to travel independently, safely and confidently in their environment and/or pro-



Table 1.
Useful Terms to Know in Discussing Visual Impairment

Acquired/adventitious	Vision loss after birth
Acuity	Visual clarity. Acuity loss refers to a decrease in visual clarity.
Albinism	Lack of pigmentation in skin, hair and eyes. Characterized by decreased visual acuity, photophobia, nystagmus, and strabismus (difficulty coordinating eye movements)
Congenital	Vision loss that is present from birth
Cortical visual impairment	Difficulty processing visual information due to damage to the visual cortex of the brain
Field	Area one can see. Field loss typically refers to decreased central vision, decreased peripheral vision, or scotomas (blind spots).
Legally blind	Vision that is 20/200 or less <i>with correction</i> , or field vision of less than 20°.
Light perception	Enough vision to tell if a light is on or off, if it is day or night, etc.
Light projection	Enough vision to determine the direction of a light source
Nystagmus	Involuntary eye movement
Optic nerve atrophy	Damage to the optic nerve, resulting in loss of visual acuity and visual field
Optic nerve hypoplasia	Underdeveloped optic nerve, resulting in nystagmus, strabismus, and acuity/field loss
Photophobia	Light sensitivity. Considerations in a PE environment include a possible need for sunglasses, a visor or cap with brim, and extra time to transition from bright to dim lighting and vice versa.
Progressive vision loss	Vision continues to deteriorate over time
Retinal detachment	Separation of the retina from its supporting layers. Can occur as a result of trauma to the head, including contact sports, diving (in a pool), or getting hit with flying objects
Retinitis pigmentosa	Field restrictions, night blindness, photophobia, reduced depth perception, scotomas, and reduced color vision. Associated with risk of retinal detachment
Retinopathy of prematurity	Eye development disrupted due to premature birth, which may result in blood vessels breaking (causing bleeding into the eye) and scar tissue (causing retinal tears). May be associated with risk of retinal detachment

vides consultative support to collaborate with other teachers on the student's team about safe movement and travel as it relates to the school environment.

- **Paraeducator/teacher assistant:** an instructional assistant who provides support with educational tasks for a classroom or a specific student.

Once educators talk with the student and his or her parents to gather information about the adaptations that the student has used before, a discussion with the team of the professionals already mentioned will help determine what other possible adaptations could be useful. See Figure 1 for a form that can help direct this communication exchange. Adaptations and specially designed instruction may include changes or enhancements to instructional strategies, the activity itself, and/or the instructional environment. The following sections of this article will discuss these three areas and provide practical tips for inclusive physical education.

Instructional Strategies

Instructional strategies are techniques that physical educators use in order to help students participate, learn, access the curriculum, and become as independent as possible in a safe movement environment. Students with visual impairments must be encouraged and provided with sufficient opportunities to move in a safe

environment in order to minimize the development of motor delays (Lieberman & Haibach, 2016; Samalot, Lieberman, & Haibach, 2015). There are a wide range of instructional strategies that can be incorporated into physical education teaching when including students with visual impairments, many of which can be offered to any student as part of a universal design for learning (UDL) approach. The UDL approach consists of lesson planning prior to instruction that provides a variety of modifications and adaptations from the beginning in order to ensure inclusion of most children in the class (Lieberman & Houston-Wilson, 2018). For example, one instructional strategy is the whole-part-whole method, which could be helpful for the understanding of *all* students in the class. The goal of the following strategies is to assist students who may need additional support in order to meet state standards, class goals, or individualized education program (IEP) goals.

Pre-Teaching. Pre-teaching means teaching elements of the next unit, activity or skill prior to the student participating in the inclusive class. Key elements for students with visual impairments to learn before the next few lessons or unit of instruction include the physical layout of a playing area, the equipment used in various games, terminology related to a game or sport, the scoring system used, the player positions involved in the sport, game strategies, and any other background information related to the unit, activity or standard. Pre-teaching may include tactile maps, orientation

and mobility practice, and actual instruction in and practice of the foundational concepts and skills.

Tactile maps or boards can help physical educators pre-teach information related to the physical layout of the playing area and player positions prior to the beginning of the unit so students are prepared to be a part of the group during class instruction and activities. Orienting students with low vision by walking around the activity space and providing them with cues and landmarks regarding the layout of equipment, doorways and typical setup of the gym can be instrumental to students' understanding of the activity. The student's orientation and mobility instructor can consult with the physical educator and assist with these strategies and can work on incorporating tactile mapping and gym/court/field orientation into their lessons.

In addition, the teacher of the visually impaired and paraeducator can assist with pre-teaching by reinforcing the information the student needs to know before the class. In order for pre-teaching to be most successful, the physical educator needs to share their lessons with members of the student's team in advance, including any key visual or written information that will be important to student learning. The addition of a one-on-one or small-group self-contained physical education class can provide additional opportunities to infuse these pre-teaching concepts before an upcoming unit in the general physical education class, where the physical educa-

tor can teach skills with the students being able to practice and get feedback before the introduction of the skills in the inclusive class.

Whole-Part-Whole Instruction. Whole-part-whole instruction is not a new concept to physical educators, and many use this on a daily basis for all of their instruction. This method involves teaching students what the entire skill is about and letting them try it, teaching each part of the skill to mastery, then combining all the parts together and having the students practice the whole skill again (Lieberman & Haibach, 2016). It is important to note that in order for all students with a visual impairment to understand the parts, the whole must be taught first. For example, the entire game of tennis must be explained and experienced before it can be broken down into the forehand, backhand and serve; otherwise, the student will lack the context in which to understand where each of these skills fit. When students cannot see the whole game of tennis, learning just a part of it without understanding the whole is not beneficial. Another example is goalball. The entire game of goalball must be understood before the child learns to dive to block a shot on goal, or roll the ball for a score (Lieberman, 2017; Lieberman et al., 2013).

Consistent, Descriptive Verbal Explanations. Children with visual impairments rely on verbal explanations as well as tactile teaching to access instruction. A physical educator must provide consistent and descriptive language to describe the visual demon-

Figure 1.
Unit Planning Form for Students with Visual Impairments

Student Name:	Grade:
Unit:	Dates of unit:
Teaching Strategies Utilized: <input type="checkbox"/> Verbal directions <input type="checkbox"/> Visual demonstrations <input type="checkbox"/> Physical guidance (instructor or peer moves student) <input type="checkbox"/> Tactile modeling (student feels instructor or peer perform the skill)	Suggested teaching strategies:
Equipment Resources: <input type="checkbox"/> Vary the size (increase or decrease) of balls and other equipment. <input type="checkbox"/> Use equipment with sounds. <input type="checkbox"/> Use equipment with color/brightness/contrast differences. <input type="checkbox"/> Use support or tie balls with strings.	Adjustments to equipment:
Environment: <input type="checkbox"/> Illumination: increase or decrease the amount of lighting. <input type="checkbox"/> Tactile demarcation: use carpets or mats with different surfaces or textures. <input type="checkbox"/> Visual demarcations: use colored "poly spots" or tape with different colors on the floor, walls and obstacles. <input type="checkbox"/> Auditory cues: provide different sounds in strategic spots to facilitate orientation. <input type="checkbox"/> Tactile boards: use tactile boards to explain the particularities of an activity area and positioning in space. <input type="checkbox"/> Modify distance between the student and peers or targets.	Modifications to the environment:

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strations that occur during class. Although using additional verbal instruction and “play-by-play announcing” are effective strategies, the teacher needs to find a balance between too little and too much verbalization, as it can be tiring for the teacher and can impede the socialization for the students. Teachers should couple this strategy with tactile modeling and then transition to cues and eventually to occasional reminders and prompts.

The first step in providing appropriate verbal explanations is to explain what the student must do in simple but descriptive terms, and then give feedback using precise, unambiguous descriptions. A statement such as, “Hold the racket three to four inches above your left shoulder” provides more feedback than “Hold the racket like this.” Precise, consistent language benefits all students, with or without visual impairments. In addition, include students with visual impairments during spectator events by assigning a student announcer to describe the “play-by-play” action for the class, much as a radio announcer describes a ball game on the radio. The student with the visual impairment never has to wonder or be left out of the activity and excitement of the class, and all students benefit from a greater understanding of what is happening in the game.

Appropriate Demonstrations. Although some students with visual impairments learn many skills through consistent and descriptive verbal instruction, others may benefit from a visual demonstration for certain skills. This instructional strategy refers to the

use of appropriate demonstrations by the instructor, paraeducator or peer tutor for students who have some vision, referred to as “low vision.” Children with low vision can be shown a demonstration in their visual field, which refers to the area that they can see, and in the proximity that is best for them. Prior to demonstrating, ask the student where the best location is to demonstrate skills. Note that this may change based on lighting conditions (indoor/outdoor, natural/artificial light, cloudy/sunny, presence of glare or shadows) and contrast (color of the equipment and clothing of the demonstrator against the background), or it may vary day to day based on the individual pathology of the visual impairment. Some students will see best from their periphery, some benefit from a particular type of lighting, and some need to be very close to the demonstration in order to see. It might be beneficial for the student to have a peer do the same demonstration in a visual field that can be easily accessed if the instructor or paraeducator demonstrations are difficult to replicate due to size difference between the instructor and the child.

Tactile Modeling. Even with the use of consistent and descriptive explanations and visual demonstrations for those who can use it, students with significant visual impairments may need additional instructional techniques such as tactile modeling and physical guidance. Physical guidance and tactile modeling have both been shown to improve self-efficacy in novel tasks for chil-



Figure 2.
Tactile modeling
for batting

dren with visual impairments (O'Connell, Lieberman, & Petersen, 2006). Tactile modeling is an instructional strategy in which the instructor or a peer models the skill, and the student with low vision feels the body motion while the skill is performed. This allows the students with low vision to comprehend how the body moves throughout the whole skill if a student cannot execute a skill or movement though verbal explanation alone. Always pair the tactile modeling with verbal cues for the skill, telling the student where and when to place his or her hands on the model and describing the name of the movement.

For appropriate touch and legal purposes, always document how much assistance was given, when and where the student used his or her hands to feel a movement on a teacher or peer, and why tactile modeling was chosen. Repeat tactile modeling as many times as necessary, and combine tactile modeling with the other instructional strategies to increase understanding. The child may get hit with a ball, fall down, or miss catching a frisbee along the way during instruction or game play. As with sighted peers, do not make a big deal out of minor scrapes, bangs or bruises as this is a natural part of physical education. See Figure 2 for an example of tactile modeling.

Physical Assistance or Guidance. Another type of tactile instruction is physical guidance, where the teacher, paraeducator or a peer assists the student physically through the movement with either partial physical assistance, such as touching the elbow for the freestyle stroke, or with total, physical assistance, such as physically moving their arms through the motion of batting a ball. Physical guidance can begin as total assistance and can be faded to less invasive support such as a light touch with a verbal cue (Cieslak, Lieberman, Haibach, & Houston-Wilson, 2015). The physical educator should record which skills require physical assistance, including how much and where on the student's body the assistance was provided. If asked for legal purposes, the teacher can explain when, where and why a student was touched. Be sure to ask the student before giving physical assistance in order to avoid startling the student. See Figure 3 for an example of physical assistance.

The Activity Itself

Activity modifications are changes a teacher makes to the equipment, the space or surface, the environment, distance to targets, or even the rules or speed of the game or activity in the lesson (see Table 2). Some key activity and fitness modifications may include the use of auditory equipment, the provision of tactile boundaries, the use of aerobic fitness equipment that is stationary, and the inclusion of guides or tethers for running activities. Some of these modifications for the activities of running, bicycling and swimming are described in Table 3. Please note that these modifications can be offered to the entire class so that the student with the visual impairment does not stand out or feel marginalized.



Figure 3.
Physical assistance for basic swimming skills

The Instructional Environment

It is important that the students' peers and physical education teachers understand the potential of children with visual impairments. There are many sports that individuals with visual impairments can perform as well as and sometimes even better than their sighted peers. Many children with visual impairments compete successfully on high school and college sports teams, particularly cross-country running, swimming and track and field teams. Some sports include opportunities specifically for individuals with visual impairments. An example is goalball, a Paralympic sport that is the most popular team sport for people who are blind or visually impaired. This can be incorporated into the curriculum along with soccer, or during a Paralympic sport unit (to learn more about goalball see <https://www.usaba.org/sports/goalball/>). See Figure 4 for an example of goalball. Another popular team sport is beep baseball, an adapted form of baseball (see www.nbba.org). Beep baseball can be infused into a disability sport unit or as part of a softball or baseball unit. These two sports utilize blindfolds for all participants, therefore equalizing the playing field for everyone and creating an environment of equality.

When looking to find information about sports that are either blind sports or adaptations to sighted sports, it is imperative to become familiar with the national governing body for sports for people with visual impairments, the United States Association for Blind Athletes (USABA; see www.usaba.org/). Teachers who have a student with a visual impairment who excels in Paralympic sports can refer them to the USABA so that they can gain further training and opportunities to compete with peers who have their same visual impairment. In addition to USABA, another resource

Table 2.
Modifications to Activities for Students with Visual Impairments

Modification Type	Example
Equipment modifications	<ul style="list-style-type: none"> • Using a larger ball • Using a bright or high-contrast ball • Using a softer ball • Deflating a ball to slow it down • Using balloons or scarves that will stay in the air longer • Adding sound sources behind goals, bases or the basketball net • Adding a beeper or bells to the ball • Lowering targets/goals, or making the goals larger • Tying a plastic bag around a ball to make noise as it rolls • Making scoring a goal audible by tying bells onto the goal nets
Rule modifications	<ul style="list-style-type: none"> • Giving the offensive player more space between self and the defender • Only using bounce passes or rolling the ball during basketball • Forgiving technicalities • Allowing more bounces in volleyball • Assigning player roles • Requiring everyone to touch the ball before scoring • Giving everyone a turn before changing possession
Boundary modifications	<ul style="list-style-type: none"> • Increasing or decreasing the size of the playing area • Placing rope under floor tape to create raised boundaries • Using caution tape or flag-rope to mark off the playing area • Providing sound sources behind goals or other target areas • Using bright tape or high-contrast colors on the floor to make boundaries • Using larger cones to mark play areas • Using colored tape to increase the contrast of equipment against the background, such as high-jump standards and poles, or the edges of a balance beam

Note: Based on concepts from Haegele & Mescall (2013).



Figure 4.
Students playing goalball

Table 3.
Cardiovascular Fitness Activity Modifications

Activity	Modification	Description
Running	Sighted guide	Runner grasps the guide's elbow, shoulder or wrist, depending on what is most comfortable.
	Tether	The runner and guide grasp a short string, allowing the runners to have a full range of motion for arm swing.
	Guide wire	The runner holds a string attached to a fixed wire and runs short, straight distances independently.
	Sound source from a distance	The runner runs toward a sound source (clap, bell).
	Sound source	The guide rings bells or shakes a noisemaker while running side by side.
	Circular running	The runner runs in a large circular motion holding a rope that is staked into the ground.
	Human guide shirts	The runner runs behind a guide wearing a bright shirt (low vision).
Bicycling	Stationary bike	Biker rides a stationary bike with no modifications.
	Tandem bike	Biker can ride a tandem bike with no modifications. The sighted person acts as the pilot (front seat), and the individual with a visual impairment acts as the stoker (back seat).
	Side-by-side bike	Biker can ride with no modifications. Two bikers can ride sitting next to each other on this adapted bike. Few balance or communication issues.
Swimming	Tapper	A sighted person taps the swimmer on the shoulder with a lightweight pole that has a tennis ball on the tip when he/she is about eight feet from the wall as a signal to turn.
	Sprinkler system	A sprinkler can be set up on deck so that water sprinkles about eight feet from the wall in order to signal swimmers of the approaching wall.
	Counting strokes	Swimmers keep track of how many strokes it takes to get from one end of pool to the other and count strokes while swimming.
	Side of the pool	Swimmers can use the side of the pool or lane lines to help them swim in a straight line.

Note: Based on concepts from Hodge, Lieberman & Murata (2012)

for sports for students with visual impairments is Camp Abilities. Camp Abilities is an international movement for providing week-long sports instruction and competition experiences for children with visual impairments, blindness or deafblindness (see www.campabilities.org for a Camp Abilities near you). Additional resources for including students with visual impairments in physical education and sports are listed in Table 4.

Summary

Children with visual impairments can excel in sports and physical activities when they are given the proper tools to experience, learn and practice. Physical educators and coaches can implement modifications in their classes using any of the adaptations mentioned in this article to enable their students to learn and succeed. Children with visual impairments should be given the opportunity to make friends and to be an active part of a physical education class or sports team. The best advice for teachers from Lindsay Ball, the Paralympian who made the opening commentary at the beginning of this article, is to “stay positive and see the possibilities and not the limitations in your students.” It is up to the physical education teacher and the child’s multidisciplinary team to create an environment that will help each student reach his or her full potential.

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Table 4.**Resources for Including Students with Visual Impairments in Physical Education and Sports**

Resource	Description	Where to Acquire
American Printing House for the Blind website	A resource website for parents and teachers	https://www.aph.org/physical-education/
<i>Encyclopedia of Sports and Recreation for People with Visual Impairments</i> (Leibs, 2012)	A–Z of sports played by people who are visually impaired or blind, along with the history, rules, adaptations and resources for each	http://www.infoagepub.com/products/Encyclopedia-of-Sports-Recreation-for-People-with-Visual-Impairments
<i>Gross Motor Development Curriculum for Children with Visual Impairment</i> (Lieberman & Haibach, 2016)	A gross motor curriculum for children who are visually impaired, blind or deaf-blind	https://www.aph.org/manuals/#alpha-g
<i>Going Places: Transition Guidelines for Community-Based Physical Activities for Students Who Have Visual Impairments, Blindness, or Deafblindness</i> (Lieberman, Modell, & Jackson, 2006)	A transition curriculum guide for adolescents who are visually impaired, blind or deafblind	
Perkins School for the Blind website	Website with many resources for working with individuals with a visual impairment	www.Perkins.org
<i>Physical Education and Recreation for Individuals Who Are Visually Impaired or Deafblind: Foundations of Instruction</i> (Lieberman, Ponchillia, & Ponchillia, 2013)	A textbook about physical education and sport for individuals with a visual impairment or deafblindness published by the American Foundation for the Blind	http://www.afb.org/store/Pages/ShoppingCart/ProductDetails.aspx?ProductId=978-0-89128-454-3
Texas School for the Blind and Visually Impaired: Physical Education Resources	Tips for modifications to physical education	http://www.tsbvi.edu/physical-education

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