Motor Competence in Children & Young People With Visual Impairment

January 2023

Executive Summary

This independent study of motor competence, physical activity, and wellbeing in children and young people with visual impairment (CYP-VI) utilised multiple methods, including rapid evidence synthesis, questionnaires, interviews, and motor competence testing. Participants included CYP-VI, their parents/carers, and a range of key stakeholders. A total of 61 children and young people and 28 parents participated in an online survey; 22 children and young people (n=7 non-sight impaired) engaged in a test of their motor competence; five families participated in a family-based interview; and six industry professionals from key stakeholder organisations participated in one-to-one interviews. Data were gathered from a geographically diverse sample across England. Data collected offer a unique insight into the scale and complexity of motor competence, physical activity engagement, and the impact upon wellbeing amongst CYP-VI aged 5-8 years old.

Headline findings

- There was a significant negative correlation between perceived motor competence and social desirability, $r(59) = -.28$, $p=.03$.
- There was a significant positive correlation between physical activity energy expenditure and participants' positive emotional state, $r(59) = .33$, $p=.01$.
- Severely sight impaired individuals scored lower on every locomotor and ball skill test than their partially sighted and non-sight impaired peers.
- Gross Motor Index mean scores between both severely and partially sighted VI groups were lower than the non-sight impaired group.
- There were pronounced differences between perceived motor competence mean scores of CYP-VI and non-sight impaired groups.
- CYP-VI reported spending 91% of their time involved in sedentary activity.
- Physical education lessons were the activity where most (n=48) CYP-VI reported being most physically active.

- Level of deprivation was shown to not be a significant predictor of psycho-social wellbeing or PAEE amongst 5-8-year-old CYP-VI.
- Qualitative data suggest that education settings offer the best environment for engaging and supporting CYP-VI to become more physically active through meaningful participation in physical education lessons.
- Qualitative data suggested schools as the most critical sites for motor competence development.
    - Key Stage 1 appeared to be less of a concern for engagement in PE lessons amongst families and industry professionals.
    - Key stages 2, 3, and 4 were suggested to be of serious concern for the engagement of CYP-VI amongst families and industry professionals.
- Qualitative data showed that parents exhibit positive attitudes toward CYP-VI participating in sport and physical activity.

Recommendations

- British Blind Sport should lead the development of an inclusive PE curriculum for Key Stages 1 and 2 that ensures all children are able to access PE and develop the necessary motor competence skills.
- British Blind Sport should position itself as an industry leader in the development of motor development in CYP-VI, building on the First Steps programme and this body of research.
- British Blind Sport should purposefully engage a national sports body to develop CYP-VI specific training and development opportunities for sports coaches and PE teachers.
- British Blind Sport should lead the way in understanding the issues and opportunities associated with PE from Key Stage 2 onwards.
- British Blind Sport should be seen as the industry leader for educational support and resources to inform parents and practitioners around the importance of sport and physical activity participation amongst CYP-VI and across the lifespan.
- That any future interventions are not only evidence-based but have other key-stakeholder involvement (i.e., parents, family, and CYP-VI) that enables a

collaborative, co-created process that empowers CYP-VI and the families to advocate for accessible sport and physical activity across multiple contexts.

- Any possible interventions concerned with motor development in CYP-VI should occur as early as possible (i.e., nursery, reception).
- Additional research and evidence are required to understand what families and industry professionals consider to be ‘good’ or ‘best’ practice in physical education for CYP-VI and how this can be developed into intervention programmes or resources.
- Awareness of opportunities - up-to-date details of local, accessible, and inclusive sports clubs with details about age-specific provision (both mainstream and VI-specific).
- Research underpinned by a social-relational understanding of disability which acknowledges the potential for restrictions of activity to result from a complex combination of impairment effects and socially imposed barriers.
- British Blind Sport should petition government to maintain investment in sport and physical activity through school transitions (i.e., primary school key stages; primary to secondary transition; secondary to further; further to higher/work; independent living) to fully support CYP-VI engagement in sport & physical activity.
- Future research in this area should seek to adopt longitudinal designs using repeat measures with the same samples. There are not currently enough high-quality studies of this nature to support evidence-based decision making or fully understand the complex relationship between engagement in sport and physical activity, motor competence development, and wellbeing in CYP-VI.

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List of abbreviations

BBS	British Blind Sport
C-PAQ	Children's Physical Activity Questionnaire
CYP	Children and Young People
CYP-VI	Children and Young People with Visual Impairment
EHCP	Education, Health Care Plan
GMI	Gross Motor Index
IPAQ	International Physical Activity Questionnaire
NCPE	National Curriculum for Physical Education
PA	Physical Activity
PAEE	Physical Activity Energy Expenditure
PE	Physical Education
TA	Teaching Assistant
TGMD-3	Test of Gross Motor Development 3rd Edition
TPMC-VI	Test of Perceived Motor Competence for children with Visual Impairment

Introduction

There are over 25,000 children aged 0-16 years old with sight loss in the United Kingdom (RNIB, 2018). This includes children who are severely sight impaired, and sight impaired. However, visual impairment does not affect the ability of children to be physically active (Lieberman, 2011; Lieberman & Runyan, 2016), yet recent studies suggest that children and young people with visual impairments (CYP-VI) do not meet recommended daily physical activity thresholds and are less likely to be as physically active as their sighted peers (Augestad & Jiang, 2015; Hagele & Porretta, 2015). Due to low levels of physical activity participation, CYP-VI also exhibit poorer health-related fitness and are at increased risk of developing mental ill-health (Brunes Flanders & Augestad, 2015; Lieberman et al., 2010). Although CYP-VI often report experiencing physical activity as being ‘fun’ and ‘enjoyable’ coupled with building confidence in their abilities to be active (Ward et al., 2011), a number of barriers inhibit their physical activity engagement including a lack of physical activity opportunities, lack of encouragement from parents and trained individuals (i.e., PE teachers, coaches) (Stuart, Lieberman & Hand, 2006). There are, however, additional factors that must be taken into consideration including the roles that motor competence and perceived motor competence play in CYP-VI being physically active (Stodden et al., 2008).

Both motor competence and perceived motor competence are suggested to contribute to an individual’s ability to perform tasks associated with physical activity (Haegle, 2019). Motor competence can be thought of as the proficiency of fundamental motor skills – the building blocks to more complex movements that are classified as being either ‘object control’ (e.g., throwing and kicking) or ‘locomotor’ (e.g., running and jumping). Studies suggest that motor competence has a symbiotic and dynamic relationship with physical activity engagement and is important in promoting physical activity across the lifespan, particularly amongst individuals with visual impairments (Houwen et al., 2015; Wagner, Haibach & Lieberman, 2013). Perceived motor competence is an individual’s perception of their physical strength, movement capability, capacity for sport, and fitness level (Fox & Corbin 1989). Young children have been shown to demonstrate limited capacity to accurately perceive their motor competence and tend to overestimate their abilities. Thus, they remain willing to continue engaging in activities because their perception is that they are being successful (Brian, Haegele & Bostick, 2016). However, as children grow older their perceived motor competence becomes more closely related to the likelihood of them being physically active. Thus, poor perception of motor competence, or a belief that they are less motor competent than their peers, might lead to withdrawal from physical activities (Stodden et al., 2008). Recent studies have suggested that visually impaired youths demonstrate poor to very poor levels of motor competence (Brian, Haegele & Bostick, 2016; Brian, Haegele & Bostik, 2018), which might also impact their desire to be physically active.

The concern is that CYP-VI are less likely to experience the range of health-related quality of life, socialisation and motor skills benefits associated with physical activity (Lieberman, 2020) and subsequently be more at risk of physical inactivity, social isolation and mental ill-health, is a valid one. Considering the impact of COVID-19 on the lives of visually impaired people and access to local sport and physical activity provision, a better understanding of the factors that restrict and enable positive physical activity experiences for CYP-VI has never been more relevant.

It is important to develop an understanding of the relational nature of CYP-VI's physical activity experiences. This requires examination of how restrictions of activity can be directly caused by visual impairment (impairment effects) and/or be socially imposed, constituting disability. Distinguishing between impairment effects and socially imposed restrictions of activity is a considerable challenge, requiring complex and multiple methods. This project has utilised in-depth literature reviewing, questionnaires for CYP-VI and parents/carers, motor competence testing, interviews with families, and interviews with key stakeholders involved in the delivery of services to CYP-VI. To begin to understand the relational nature of CYP-VI's physical activity experiences and provide a fundamental base for future research in the area.

Aims & Objectives

- To identify and demonstrate the gaps in physical development and motor competence in children with visual impairment.
- To understand the sport, physical activity, and active play choices and habits of children with visual impairment.
- To consider how participation in sport and physical activity affects the mental and social wellbeing of CYP-VI.

Literature review

They are key features of children’s development, although they rarely receive equal attention to domains such as cognitive, social, and personal development in developmental science literature. Motor competence plays a crucial role in healthy emotional and social functioning, and impacts children’s well-being in numerous ways (Payne & Isaacs, 2017). Movement plays a pivotal role in children's development and learning. Observations of almost any infant, in almost any setting, will provide ample evidence for this claim. Through movement, children learn about their bodies, their physical and social environments, they try out different rules and rules, and they learn to capitalise upon the learning opportunities presented to them. In the words of the great child psychologist, Jerome Bruner, movement, action, and play make up the "culture of childhood" (Bruner, 1983: 134).

Children with VI often experience difficulties acquiring certain motor skills, and consequently have delays in their motor development (Haegele, 2020; Houwen et al. 2009). Understanding the causes of these problems should help provide a basis for the development and improvement of support programmes and strategies, and the more successful inclusion of CYP-VI in schools, sports clubs, and elsewhere. Poor motor competence may lead to delayed or withdraw from many everyday activities, resulting in reduced self-esteem, diminished health, and social isolation (Bailey, Doherty, & Pickup, 2007). Children with VI may be especially vulnerable to these movement difficulties, increasing the risk that they will also suffer from associated psychological and social problems (Haegele, 2020). So, it is important to understand the motor development of CYP-VI, the challenges they face in this regard, and evidence-based interventions for helping them.

There are numerous publications offering guidance on the support and promotion of movement among individuals with VIs (e.g., Lieberman, Ponchillia, & Ponchillia, 2013; Liebs, 2012). However, it is only in recent years that a body of research has developed to provide the necessary evidence base for these practices (Haegele & Lieberman, 2019). This has included systematic reviews of the scientific literature (e.g., Barnett et al. 2016; Holfelder & Schott, 2014; Wick et al. 2017). This report seeks to bring together the available evidence regarding the motor competence, physical activity, and well-being of children with VI. However, motor competence is an area often muddled by inconsistently used terminology and ambiguous conceptualisations, so the first sections suggest some working definitions and explanations of some of the key terms, influential models, and general patterns of motor development. It then outlines key findings from research into patterns of motor development for infants and of school-aged children with VI. A central part of this report is a review of the relationship between the motor competence and physical activity of CYP-VI. This is followed by a survey of interventions to support motor competence of CYP-VI.

Key Terms

For the sake of clarity, this review will use five key concepts:

- Motor development;
- Motor competence;
- Perceived motor competence;
- Motor skills;
- Fundamental motor skills.

The word 'motor' is used here as the central construct, but it should be acknowledged that some authors use other terms for similar, or even the same, idea.

The most common of these is ‘movement’. For example, some writers talk about ‘movement development’, ‘movement competence’, and (most commonly) ‘movement skills' (Bailey, 2000; Peers et al. 2020). The last phrase on this list - ‘movement skills’ - has become widely accepted in the scientific literature and will be used in this document as synonymous with ‘fundamental motor skills’ (Duncan et al. 2020). However, there is a technical difference between ‘motor’ skill and ‘movement’ skill that ought to be born in mind: ‘motor’ skill emphasises the relative contributions of the underlying mechanisms (neural, muscular, biomechanical, perceptual); ‘movement’ skill emphasises what can be observed. In other words, “the laboratory scientist tends to focus on the “motor” aspects of skill while the field professional tends to focus on the observable “movement” aspects of skill” (Goodway, Gallahue, & Ozmun, 2020: 16).

Motor development refers to the changes in motor behaviour over the lifespan and the processes which underlie these changes and the factors that affect them (Clark and Whitall, 1989). It begins at birth and ends with death as human beings are constantly changing based upon how they, as individuals, interact with the environment across time. Therefore, Sugden & Wade (2013) suggest including the term ‘adaptive change’ to definitions of motor development. It draws attention to the transactional relationship between the individual and environment and development occurs in many ways.

Motor competence is the ability to execute a wide range of motor acts in a proficient manner, including coordination of motor skills that are necessary to manage everyday tasks, such as walking, running, jumping, catching, throwing, kicking, and rolling (Barnett et al. 2016). It indicates the management and expression of motor skills as a contextualised response. Including a discussion of motor competence directs attention of the developing individual in the process of becoming something other than what he or she is at the moment (Sugden & Wade, 2013). The capacity to control movements changes so that learners become more accurate and faster in their responses. They also develop more precise force control to increase the range of movements that can be stronger, as well as slower and more subtle. Movements become more coordinated and fluent, with fewer extraneous movements. People with relatively advanced motor competence have learned to produce the appropriate forces at the right time and in the right directions; they have learned to avoid counter-productive actions and to exploit passive forces, such as gravity. As a result of practice, movements are produced with less physical effort (Wulf & Lewthwaite, 2010).

The establishment of motor competence is typically associated with the acquisition of a richer repertoire of movements, allowing the learner to produce variable and efficient solutions to movement problems. Multiple demands can be handled more quickly, including the ability to relate movements to the movements of others. These are often accompanied by the developing ability to plan and anticipate what others are likely to do. In each context, individuals have to evaluate the quality of their movement repertoires to resolve the problems that arise in everyday environments (such as play or sport) effectively and efficiently (Fort-Vanmeerhaeghe, Román-Viñas, & Font-Lladó, 2017). In other words, motor competence is the contextualised manifestation of motor skills. Herrmann & Seelig (2017) characterise the key elements as follows:

Basic motor competences …

- can be learned and retained in the long-term and take into account previous experiences;
- are explicitly context-independent and refer to situation-specific demands in the culture of sport and exercise (e.g., handling a ball in ball sport);
- are functional performance dispositions that manifest themselves in behaviour that is oriented toward mastery.

Well-developed motor competence helps people have a greater repertoire of motor options in which they feel competent to decide on their lifestyle. However, motor incompetence can lead to inhibition or avoidance of movement opportunities, which in turn generates more incompetence and fewer opportunities. Thus, motor competence is not just performing the motor skills, but also applying them effectively in different contexts and with individuals.

Perceived motor competence can be defined as an individual's perception of their capability to perform motor tasks (Morano et al., 2020). As with other aspects of motor development, this is an area of terminological debate, with the literature referring to 'perceived physical competence', 'perceived motor proficiency', 'perceived physical ability', 'perceived physical self-concept', and 'perceived sports/athletic competence' (Estevan & Barnett, 2018). Although it remains a matter of debate, it seems to be as important a predictor of engagement with activities than actual motor competence, as it is considered a primary motivational factor underlying voluntary participation in physical activity (Barnett et al., 2011). If individuals do not think that they can do something, regardless of whether they actually can or not, they will tend to opt-out of activities. But what they think about their abilities to do something is highly influenced by whether or not they really can do those activities (Haegele, 2020). Therefore, perceived motor competence is an important factor in understanding how and when to support and predict the behaviours of learners in movement settings (Babic et al., 2014).

The term 'motor skills' refers to the ability to perform selected object control and locomotor skills. The acquisition of these types of skills does not happen 'naturally' over time, so they typically require practice, instruction, and structured training (Hardy et al., 2012). An early expression of this perspective came from Knapp (1963), who defined a (motor) skill as "the learned ability to bring about pre-determined results with maximum certainty; often with the minimum outlay of time or energy or both" (p. 136).

Gross motor skills entail the use of large muscle groups that requires movement of the whole body in the performance of activities such as maintaining balance, walking, sitting upright, jumping, throwing objects, etc. Fine motor skills involve limited movements of parts of the body in the performance of precise movements. The manipulative movements of sewing, writing, typing, tying shoes, and using scissors are generally thought of as fine motor skills (Goodway, Gallahue, & Ozmun, 2020). The distinction between fine and gross skills is not clearly delineated, but generally speaking, professionals working in sports coaching and development, physical education and related fields focus on gross motor skills, as these are the skills most closely connected with sport and other physical activities, as well as daily movement around their local environment.

The development of a strong foundation of motor competence requires the development of the coordination and control of complex multi-segmental movements. Fundamental motor skills (FMS) are a sub-set of gross motor skills that individuals begin to learn during early childhood. FMS are comprised of locomotor, stability, and object control skills. Locomotor skills propel the body from one point in space to another and include galloping, jumping, leaping, hopping, running, and sliding (Logan et al., 2018). Object control skills, also known as manipulation skills, encompass the reception, propulsion, and/or manipulation of an object with either the hand or foot (Goodway, Gallahue, & Ozmun, 2020). Object control skills include throwing, kicking, catching, striking, rolling, and dribbling. Finally, stability skills help people sense a shift in the relationship of the body parts that alter one's balance, as well as the ability to adjust rapidly and accurately to these changes with the appropriate compensating movements (Goodway, Gallahue, & Ozmun, 2020). These skills have traditionally been categorised as underlying abilities for locomotor skills but, recently, researchers have argued that they ought to be considered as stand-alone FMS (Goodway, Gallahue, & Ozmun, 2020; Rudd et al., 2015).

Several terms have been used to describe fundamental motor skills such as 'gross motor skills' (e.g., Mostafavi et al., 2013), 'fundamental motor patterns' (e.g., Barnett et al., 2012), 'fundamental movement skills' (e.g., Barnett et al., 2015), and 'foundational motor skills' (Hulteen et al., 2018). The rationale provided by the authors was that "foundational underpins a significant conceptual adaptation to broaden the scope of skills considered important for promoting physical activity and other positive trajectories of health across the lifespan" (Hulteen et al., 2018: 1533). However, since 'fundamental motor skills' continues to be the most widely used term, it is used in this report.

The acquisition of these skills represents a vital phase of children's motor development, as FMS are both direct and indirect building blocks of more advanced, complex movements that require locomotor, object control, and stability skills (Logan et al. 2018).

Table 1: Movement skill themes

Locomotor Skills	Stability Skills	Object Control Skills
Walking	Balancing	Throwing
Running	Landing	Catching
Hopping	Turning	Striking
Skipping	Twisting	Kicking
Bouncing	Bending	Dribbling
Leaping	Stretching	Bouncing
Jumping	Extending	Pushing
Rolling	Flexing	Pulling
Galloping	Hanging	Carrying
Sliding	Bracing	Trapping
Dodging	Rotation	Collecting

The Importance of Early Experience

A popular view that may have been responsible for delaying research is that motor development happens primarily due to the maturation of the central nervous system, in which there is a predetermined sequence of motor competence acquisition, with minimal influence of the environment and experience (e.g., Gesell, 1933; McGraw, 1949). Presumably, the origin of this view stems from the fact that rudimental motor skills do not seem to need to be explicitly taught. Many of these skills, such as crawling, walking, running, and jumping, seem to just appear within children's repertoire of behaviours (Clark, 2007). Contemporary perspectives adopt a more holistic view involving contextual and biological factors, which places greater importance on the role of learned abilities to perform motor skills as a result of practice or experience (Goodway, Ozmun, & Gallahue, 2020), although the processes involved are complex, changing through an interplay between an individual's biological constraints and the environment (Clark, 2007). Although very young children express several reflexes that are embedded in the nervous systems and are pre-determined, most early motor behaviours (such as species-typical or phylogenetic behaviours) are more like pre-dispositions to perform certain actions requiring environmental stimulus for their appearance. This seems to apply equally to motor and psycho-motor skills, and both sets of capabilities are modified through the continuous interaction between growing child and her stimulus-rich environment, providing an expanding set of psycho-motor and motor experiences that will help shape her motor competence. So, maturation and heredity prescribe and govern numerous biological systems (central nervous, sensory, muscles, skeleton, etc.), but these are modulated by the environment and experience.

A second version of the maturation assumption is that there is a "window of opportunity" for developing movement skills and that if that window is missed, movement development will be severely limited, more even halted (Balyi and Hamilton, 2004; Barela, 2013). According to many of the published motor development models (e.g., Clark & Metcalfe, 2002; Gallahue, 1982; Gallahue & Ozmun, 1989), fundamental motor skills have been mastered by the age of seven years, and that later development will be stymied without this foundation. If taken literally, this claim has enormous implications, if it turns out to be true. If, as had been suggested in various models, such as long-term athlete development (Balyi and Hamilton, 2004), early childhood is a critical period in movement competence, then to key implications would seem to follow: a concerted effort should be made to help children develop a wide range of motor skills before that period ends; there is little point investing time in supporting movement competence after the end of the period.

Direct empirical evidence in favour of this claim is limited, and the evidence that is available is rather outdated (e.g., Viru, Loko, Harro, et al. 1999). So, the question arises: why is the idea that there is a "use it or lose it" threshold in motor development? Part of the explanation for this phenomenon may be traced to the widely held belief that motor development is largely a matter of maturation, as discussed above. A second possible explanation is that practice-orientated researchers have conflated two distinct concepts from human development research. This is the implication of Bailey and colleagues (2010) analysis in their comprehensive review of the literature on this topic player development. The authors of this review claim that many discussions failed to distinguish between 'critical periods' and 'sensitive period'. The use of the term critical periods suggests some unique, special and otherwise unobtainable advantage to the effective exploitation of the period so described. Thus, for example, the identification of a critical period for motor skills acquisition finish around 7 years of age, would suggest a focus on this threshold is imperative and, if not realised in time, will never be fully achieved. There are obvious and strong implications attached to the use of this label, together with significant consequences for important constructs, such as early specialisation. However, there is a distinct lack of empirical support for such a pervasive and powerful construct. In contrast, the use of the term sensitive periods suggests a 'softer' relationship. Thus, if the example period used in the previous definition is described as sensitive, extra gains may be expected for the same efforts in, rather than before or after, the age span identified. However, no claims are made about whether equally profound gains may not be made by training volume (albeit perhaps larger) completed at another time.

Biologically or neurologically based arguments for early emphasis on motor competence is hard to come by. However, it does not follow that there is no benefit from early exposure of stimulating movement opportunities. On the contrary, there is a substantial body of literature supporting the intuitive idea that young children should usually be expected to develop a broad range of motor skills by the time they reach 7 years of age, or so. It seems clear that early motor development periods are vital to later skill attainment (Clark, 1994; Goodway, Gallahue, & Ozmun, 2020). So, for example, sporting skills, such as striking or throwing towards a target presupposed the existence of more fundamental motor skills. These, in turn, rely on more rudimentary skills, such as turning and balancing (see Figure 1).

This seems to be a syntactical, rather than a biological requirement, as it is based on assumptions about the logical organisation of motor skills: learning complex skills require the prior acquisition of simpler skills, and if fundamental motor skills are not acquired, children will encounter difficulties when trying to learn later motor skills. Seefeldt (1980) called this a "proficiency barrier" and suggested that competency in FMS was necessary to break through a hypothetical "proficiency barrier" that would allow individuals to apply these FMS to sports and games. Similarly, Clark and Metcalfe (2002) wrote of the "mountain of motor development" and suggested that FMS are a precursor to context-specific and skilful movement. That is, to reach the "top of the mountain" of motor development and be physically skilful and active, children must first acquire competency in FMS to apply these skills in different contexts. There is growing evidence of the relevance of these ideas for understanding motor development (Brian, Getchell, True, et al. 2020; De Meester et al. 2018).

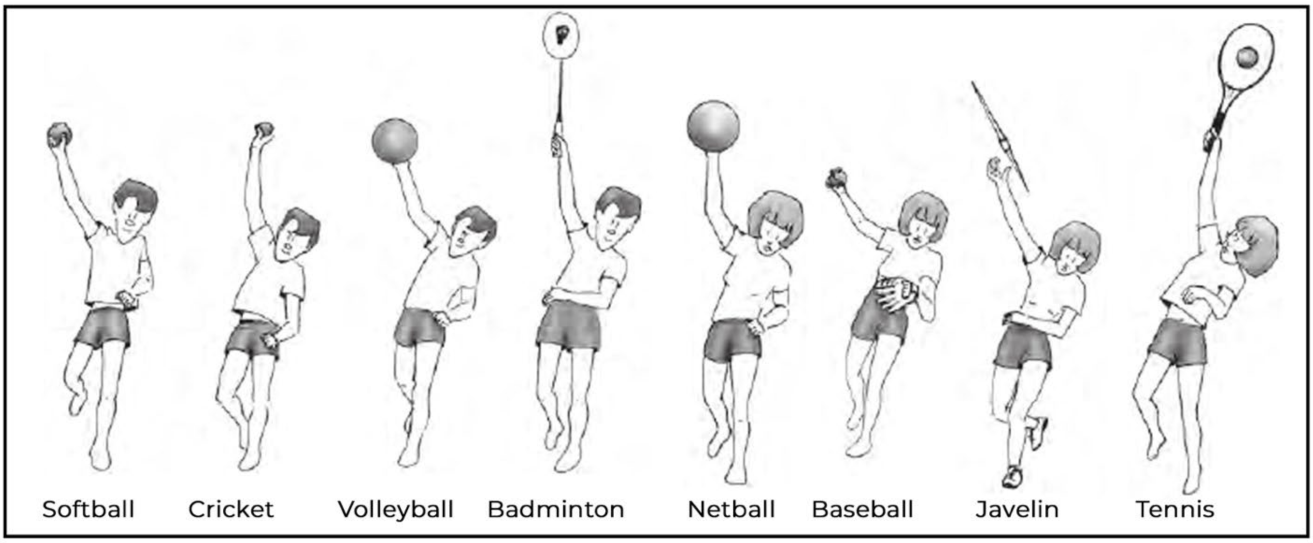


Figure 1: *Relationship between a fundamental motor skill and sport-specific skills*

Source: *Walkley et al. (1996)*

Hulteen et al (2018) incorporated the concept of the proficiency barrier in their account of 'foundational skills' (by which they mean a slightly broader conception of FMS directed specifically at sporting and other forms of physical activity participation). As can be seen, their account recognises the potential cultural and geographic specificity of movement skills and acknowledging attributes such as health-related fitness, weight status, and psychological constructs (perceived competence and self-efficacy) which affect lifespan movement skill development (Figure 2). The central message from this model, however, is that motor competence is realised by a progressive process of development from reflexive and rudimentary motor skills to more advanced and context-specific skills. From the Rudimentary Skills stage, these skills are "refined, combined, and elaborated" (Bailey, 2000, p. 80) as learners become more able to apply their competence in formalised settings, such as sport.

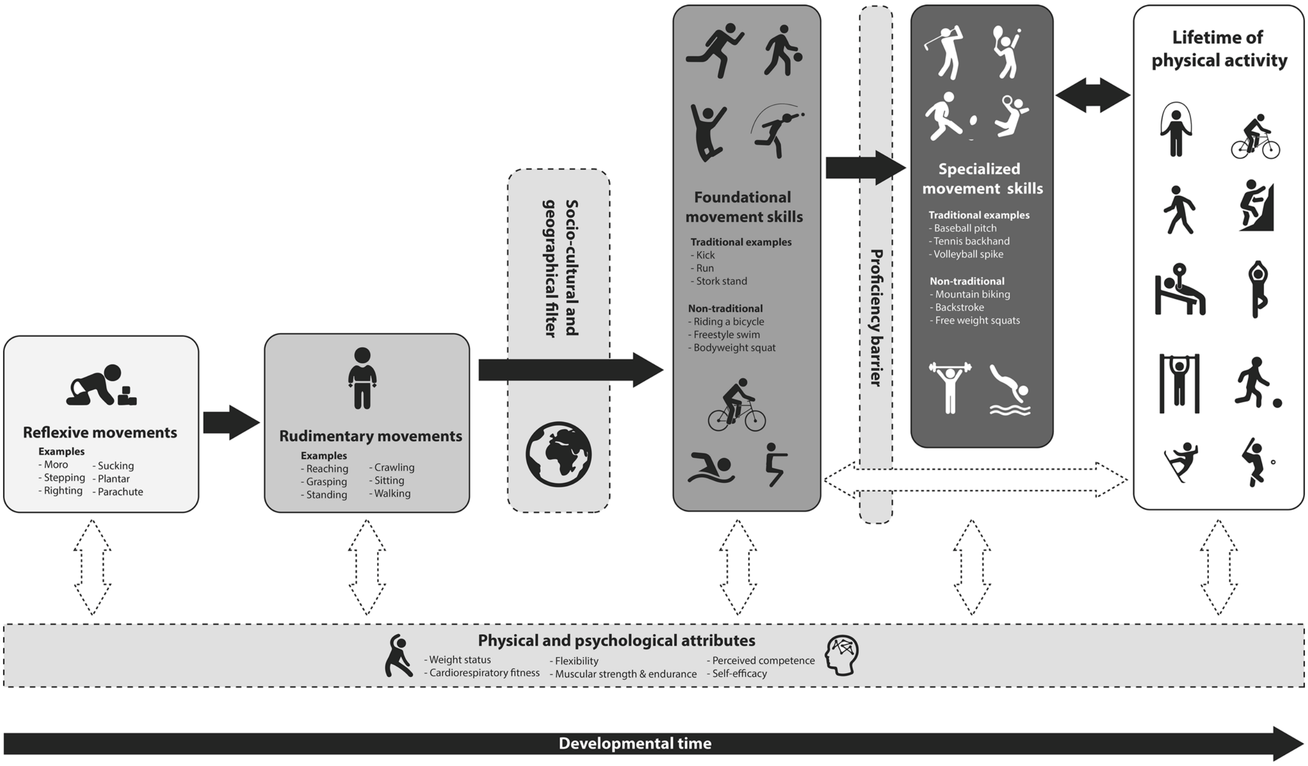


Figure 2: *Identifying a motor proficiency barrier for meeting physical activity guidelines in children*

Source: *Hulteen et al. (2018)*

The essence of this model is consistent with the other models reviewed in this report (Seefeldt, 1980; Clark & Metcalfe, 2002; Gallahue and Ozmun, 2006; Stodden et al., 2008). Fundamental motor skills as building-blocks of later motor skill competence related to sport-specific movements and skilfulness. If these motor skills are not mastered during childhood, children may encounter difficulties when learning more complex motor skills and even not continue to pursue participation and to progress in motor activity towards skilfulness. There is also a consensus among researchers in the field that motor development is not solely a process of maturation; it does not occur naturally, or as the inevitable result of the passage of time (Brian, 2020). Rather, motor development is significantly affected by engagement in developmentally appropriate tasks specifically designed to promote motor competence (Brian et al., 2019). While there is no biological ticking clock *requiring* that the skills underpinning this competence are learned within a specific timeframe, it is highly beneficial for children to acquire and develop proficiency in fundamental motor skills during early childhood. It may be the case that some cane able to learn a basic level in a restricted range of FMS in a restricted range without explicit guidance and practice, but it seems like that some sort of pedagogical intervention is necessary to maximise their potential to progress to increasingly complex and context-specific skills as they move through later childhood and adolescence (and on to adulthood) (Brian et al., 2020). Missing such interventions also increases the likelihood that children. Without such early movement experiences and regular practice opportunities throughout the early years and childhood, children will be more vulnerable to developmental delays, with implications for their education, health, and well-being.

Models of Motor Development

Numerous models of motor development have been proposed by scholars. In the words of Keeves (1988), "the model, like the hypotheses, which are contained within it, can be built from accumulated evidence, intuition by analogy, or derived from theory" (p. 559). Models typically involve important an idea from another domain to help make current knowledge more understandable. So, the human nervous system is sometimes likened to a telephone operating system and the eye is explained with reference to a camera. There is no implication in these examples that the nervous system and the eye can be equated with telephone systems and cameras; these metaphors are merely used to facilitate a better understanding of complex concepts (Payne & Isaacs, 2017).

Since models attempt to reflect the knowledge of the time in which they are developed, they are likely to change as more evidence becomes available, and more sophisticated theories emerge. This has been the case with the field of motor development. These models have usually not been presented as comprehensive theories of motor development. They are more like 'heuristic' devices - that is, conceptual device, or models, of motor development, that provides general guidelines for describing and explaining motor behaviour (Goodway, Ozmun, & Gallahue, 2020). So, rather like metaphors, effective heuristics should helpfully capture the central features of a particular phenomenon and provide clues for how to search for answers to given problems. Five models will be discussed in this section:

- Seefeldt's (1980) 'Sequential Model of Motor Development';
- Clark & Metcalfe's (2002) 'Mountain of Motor Development';

- Ozmun and Gallahue's (2017) 'Triangulated Hourglass' model; and
- Stodden et al.'s (2008) developmental model.

These models have been selected for attention partly because of their influence within the on-going field of motor development (Goodway, Ozmun, & Gallahue, 2020; Hulteen et al., 2018), and because they help highlight some of the central themes that need to be considered in any informed application of key principles with young learners.

Although it is an old model, Seefeldt's (1980) model is important because it set the terms of discussion and experimentation for most subsequent approaches to motor development. Indeed, his core insights continue to guide researchers to this day (Brian et al., 2020; Logan et al., 2018; Malina, 2014). At the heart of this model is the claim that motor development occurs through a progression through developmental phases that were represented in a simple conceptual model (see Figure 3).

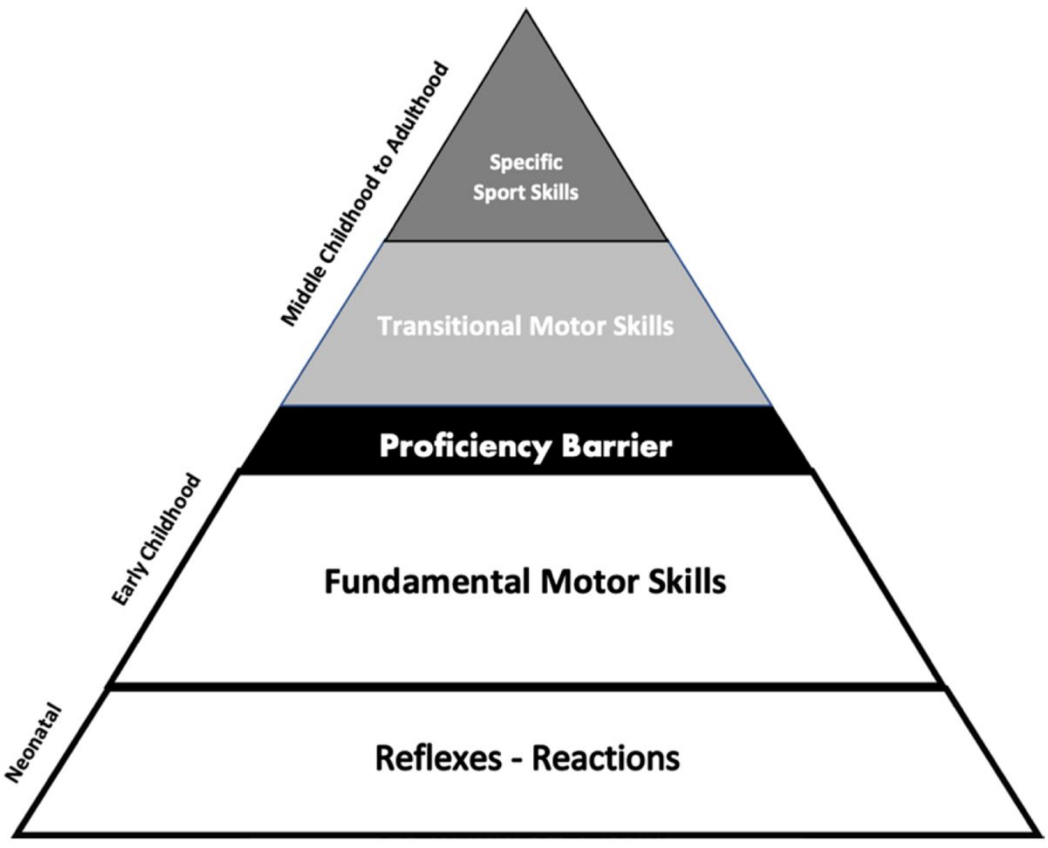


Figure 3: *Sequential Model of Motor Development*

Source: *Seefeldt (1980)*

The first period consists of primitive reflexes (e.g., Palmar Grasp, Babinski, Tonic Labyrinthine Reflexes) and postural reactions associated with infancy (e.g., rolling, sitting up, and pulling up to stand) (Vargiami & Zafeiriou, 2020). Motor development has its beginnings in these early movements. During early childhood (from about 2 or 3 years), when FMS acquisition starts to take shape, and these skills are precursors to activities that require more skill-specific adaptations for games and sports, that Seefeldt called 'Transitional Skills', which assist with the change from basic patterns to context-specific use of skills in games and activities, and then 'Specific Sports Skills'. Between FMS and these two phases is the 'proficiency barrier', as discussed above. Seefeldt commented, "The proficiency barrier is placed between the 'fundamental' and 'transitional' skills because our work has shown that children who are deprived of learning the fundamental skills have difficulty when they attempt to learn the transitional motor skills (pp. 316)".

As its name suggests, Clark and Metcalfe's (2002) model uses the metaphor of learning to climb a mountain to help explain motor development as a "lifelong, cumulative, and progressive adaptation" (p. 21). The Mountain of Motor Development highlights the importance of both biology and environment in driving change across six phases of development. Children will follow different trajectories up the mountain (influenced by differences in abilities, environmental constraints and practice) to reach the top, which is compared to the attainment of skilled motor action (Clark & Metcalfe, 2002). Like motor development, learning to climb takes many years, is a sequential and cumulative process, and is strongly affected by the personal skills and traits the individual brings to the mountain (Salehi, Sheikh, & Talebrokni, 2017). Also, both processes are non-linear process, characterised by progression, sometimes followed by regression, only to progress again later.

Following a similar line of argument to Sugden and Wade (2013), Clark and Metcalfe (2002) frame motor development as a continuous interaction between the learner and her motor skills (the climber) and the constantly changing environment (the mountain). The time spent in each period of development varies for each individual while being highly dependent on factors like the amount of experience or instruction, quality of instruction, and inherent individual qualities (such as height, strength, movement speed) that govern motor skill acquisition.

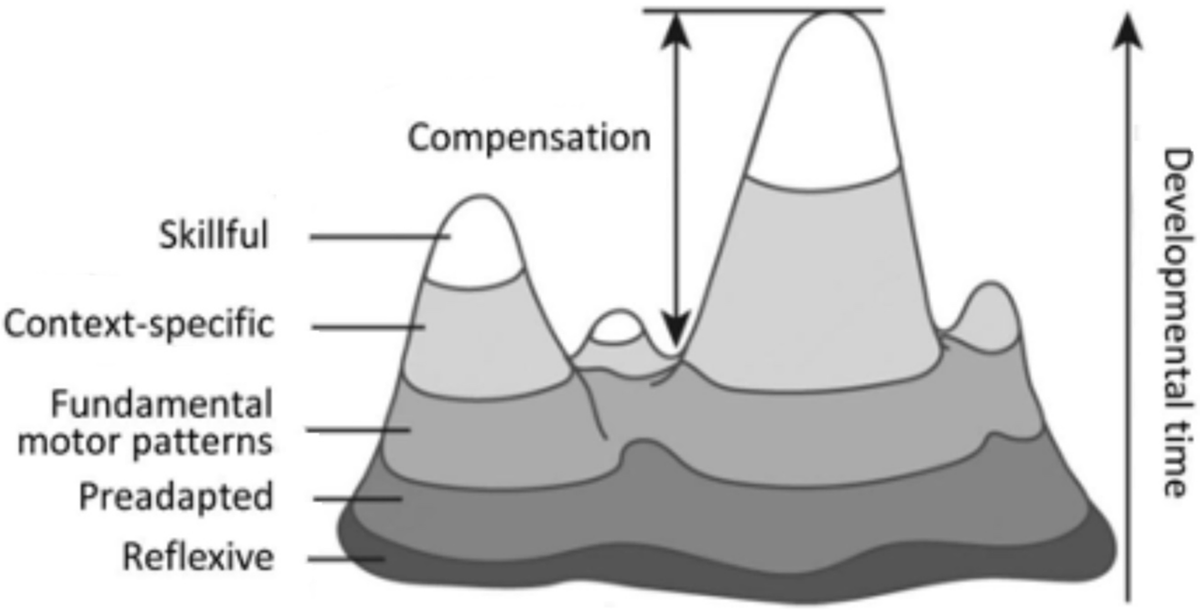


Figure 4: *The Mountain of Motor Development*

Source: *Adapted from Clark and Metcalfe (2002)*

They follow Seefeldt (1980) in proposing a staged progression of motor development, in which reflexes and/or rudimentary movements provide a neurological basis for the development of movement skills, and FMS provide a broad base of skills necessary to promote the greatest potential for skill transfer. Clark and Metcalfe (2002) call this foundation ‘base camp’. Those with a stronger base will have the potential to acquire a greater repertoire of motor competences to apply in a variety of settings.

Gallahue and Ozmun’s (2006) ‘hourglass model’, and latterly their ‘triangulated hourglass model’ (Ozmun and Gallahue, 2017) explicitly built on the assumptions within Seefeldt’s framework. It is a heuristic device for conceptualising, describing, and explaining the age-related, but not age-determined, process of motor development (Figure 5). Children at the fundamental movement stage (2–7 years old) are building upon previously learned movements from the reflexive and rudimentary movement phases and are preparing for the acquisition of more advanced skills within the sport-specific stage. Boys and girls have the developmental potential to master most of the FMS by about 6 years of age (Gallahue and Ozmun 2006).

Therefore, the early years (±3–7 years) are an important period in the development of these skills (Goodway, Gallahue, & Ozmun, 2020).

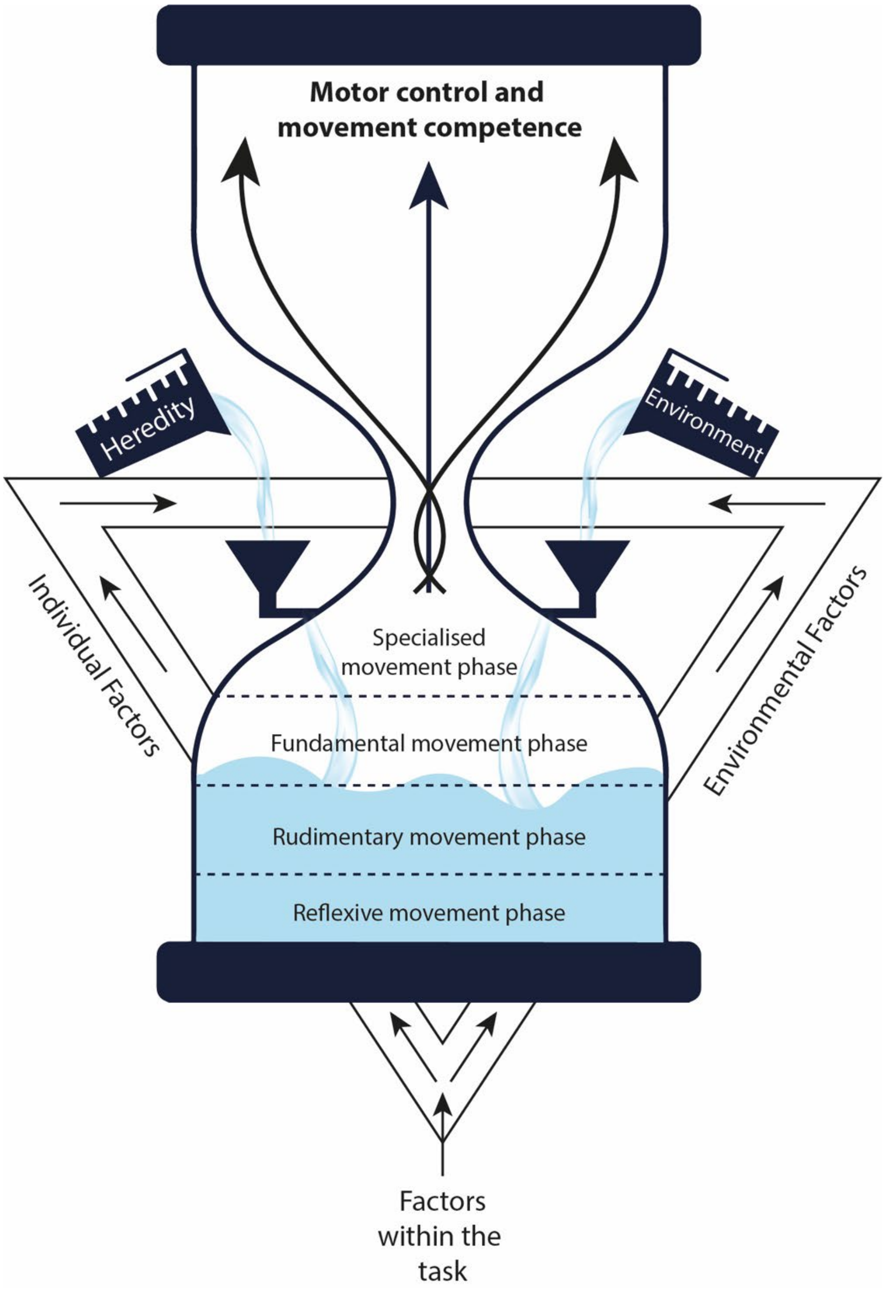


Figure 5: *Triangulated hourglass model*

Source*: Ozmun and Gallahue (2017)*

Studies conducted in Australia suggested that all FMS should be mastered by 10–11 years of age, so it is reasonable to expect that high school students should be able to demonstrate a broad motor competence (Walkley, Holland, Treloar, et al. 1996).

Finally, Stodden and his colleagues (2008) created a conceptual framework which accounted for the potential recursive effects between the development of motor competence and participation in physical activity (Figure 6). According to this model, motor competence is a key component to positive health trajectories, specifically physical activity, and mediated by perceived motor competence and health-related fitness. These relationships have been studied using various moderators and mediators of effect, such as specific psychosocial variables and specific domains of health-related fitness (Barnett et al., 2011; Lopes et al., 2019).

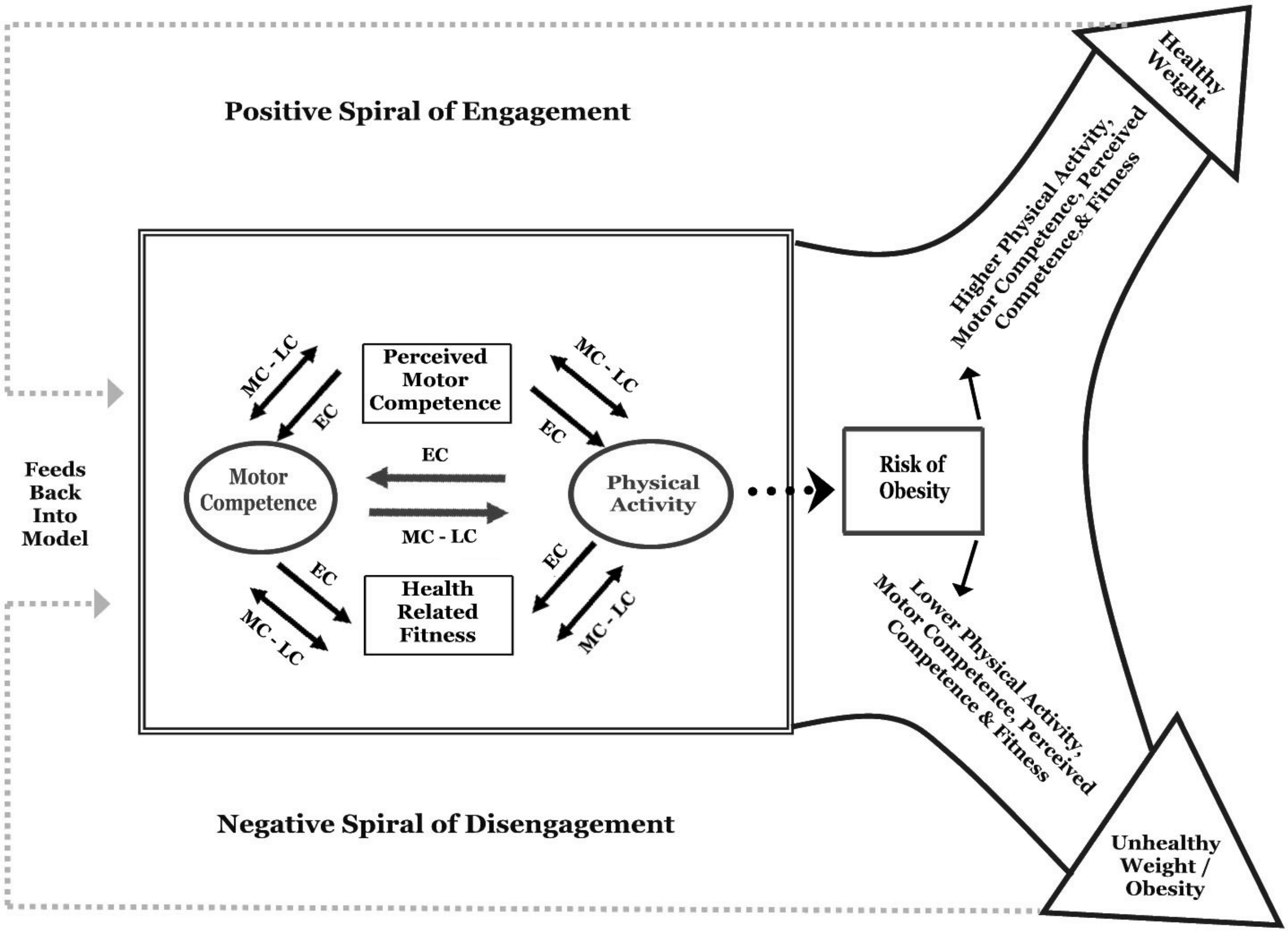


Figure 6: *Developmental mechanisms influencing physical activity trajectories of children*

Source: *Stodden et al. (2008)*

It has also been postulated that the link between gross motor skills and physical activity is bidirectional, depending on a child's developmental stage (Robinson et al., 2015). Stodden and colleagues (2008) suggested that the relationship between motor competence and physical activity will be weak during the early years due to the wide variability in motor skills and physical activity, driven by differing levels of experience and environmental constraints (parental influences, socio-economic status, physical education etc.). Over time, however, children with greater motor competence will be more compelled to engage in physical activities, whereas less competent children will begin to withdraw from physical activity. These compounding factors will in turn strengthen the relationship between motor competence and physical activity in the middle to late childhood period. This dynamic relationship between motor competence and physical activity is central to Stodden's model, but the model also recognises that this relationship will be mediated by levels of health-related fitness and perceived motor competence. These mediating relationships between motor competence and both health-related fitness and perceived motor competence are also hypothesised to become stronger over time as neuromotor and cognitive systems develop.

The stress on health-related fitness in Stodden's model is an important contribution to the evolving understanding of motor development. Unlike earlier accounts, they suggested fitness will mediate the association between motor competence and physical activity. In other words, children with more advanced motor competence will develop greater health-related fitness, which will allow them to persist and sustain physical activity engagement. Children with poor motor competence will fall into a 'negative spiral of disengagement' as poor fitness will restrict their ability to be physically active, which further limits the development of motor competencies. This links with Stodden and colleagues' second claim that there is bidirectionality among these constructs, so children with low motor competence will not continue to be as physically active in middle childhood, and will, therefore, not be able to develop or maintain aspects of health-related fitness (which they call a 'negative spiral of disengagement').

In other words, Stodden and colleagues' (2008) developmental model claims that the development of proficient motor competence and positive perceived motor competence are key components in the promotion and sustenance of physical activity engagement over time. In many ways, it can be understood as an extension of earlier models of motor development but adding the important dimension of health.

Empirical research is increasingly corroborating its central claim of associations between motor competence and a range of developmental and well-being outcomes in youth, including reduced sedentary behaviour (Lopes et al., 2012); reduced cardio-metabolic risk (Burns & Brusseau, 2017); enhanced health-related fitness (Lima et al., 2019); and a host of other outcomes associated with well-being (Lopes et al., 2013; Haapala, 2013). The directions of these associations are still a matter of debate, and further research is needed to fully understand the complex interactions (Lopes et al., 2019), cross-sectional data (comparing different groups at a single point in time) provides convincing support for a positive association between motor competence and physical activity (Schott & Holfelder, 2015; Xin et al., 2020). Even more robust support comes from longitudinal studies (over time, from childhood or adolescence, or adolescence to adulthood) suggesting that an appropriate motor competence is a positive predictor of later levels of total physical activity (Britton et al., 2020; Lloyd et al., 2014; Lopes et al., 2019). Overall, these findings support the claim that appropriate levels of motor competence are essential for children´s healthy growth and development and are critical in the promotion of lifelong active lifestyles and health. Which raises the issue of the motor development, physical activity, and well-being of children with visual impairments.

Motor Competence, Physical Activity, & Children with Visual Impairments

Physical Activity and Well-being

Stodden's model was presented earlier in this report. He and his colleagues (2008) built upon existing frameworks of motor competence but extended the scope of investigation to include the potential recursive effects between the development of motor skills and participation in physical activity (see Figure 5). The question of the relationship between motor competence and children's physical activity is of considerable contemporary relevance. It certainly seems intuitively plausible that a sound motor competence enables children to participate in various physical activities and physically active play, and there is a growing literature asserting that case (Gao & Wang, 2019; Luz et al., 2017; Robinson et al., 2015). It has also been suggested that motor competence during childhood acts as a foundation for subsequent engagement with active lifestyles (Barnett et al., 2009).

The relationship between physical activity and physical health is strong, as it is between inactivity and ill-health (Bailey et al., 2013). Increasing physical activity and physical fitness are associated with reductions in relative risk of death, and while decreasing them increases the risk (Li et al., 2020). A dose-response appears to exist, so the more active an individual is, the greater the health rewards (Erikssen et al., 1998). Even relatively small improvements in activity are associated with a significant reduction in risk (Wen et al., 2011). Generally, fit and active people have been found to have more than 50% risk reduction than their sedentary peers and increasing energy expenditure from physical activity by 1000 kcal (the equivalent of 2 hours of recreational sport) per week has been associated with a 20% reduction in risks of death (Myers et al., 2004).

Current international recommendations state that school-age youth should participate in 60 minutes or more of moderate-to-vigorous physical activity each day (World Health Organisation, 2010). It is now well-established that there are negative secular changes in children's physical activity in recent years of children spending more time engaging in sedentary behaviours, and spending less time being physically active (Verloigne et al., 2012), so many children struggle to achieve the recommended levels of daily PA (Hallal et al., 2012). The awareness of the health costs of inactivity and sedentary behaviours is so advanced among both scientists and policymakers that inactivity is now recognised as a major public health concern (Kohl et al., 2012; World Health Organization, 2010). The high prevalence of childhood obesity, evident globally in the past decade, is partly due to low physical activity (World Health Organisation, 2015). Obesity and low cardiovascular fitness in children may increase the risk of hypertension and hypercholesterolemia during childhood and may contribute to the development of chronic diseases in adulthood, such as hypertension and diabetes (Erixon, Brand & Krol, 2014). Participating in regular physical activity plays a significant role in the prevention of and decrease in childhood obesity and chronic diseases, thereby contributing to the prevention of chronic diseases later in adulthood.

Discussions of the outcomes of physical activity have focused on physical health and physical disease. However, it has been argued that these health benefits are merely aspects, or even positive side effects, of a more wide-reaching, holistic contribution that physical activity makes to human development (Bailey et al., 2013). If this is the case, it would be expected that the positive outcomes of engagement in physical activities would extend beyond improvements to health. As it turns out, this is the case.

The Human Capital Model (HCM) (Bailey et al., 2013) is a framework for thinking about the holistic outcomes and processes of physical activity. Underlying the HCM is an assertion that the stock of competencies, knowledge and personal attributes are embodied in the ability to take part in sporting and other physical activities, and that these activities produce values that are realised through increased well-being, via six different forms of 'capital'.

Figure 7: *The Human Capital Model*

Source: *Bailey et al. (2013)*

1. Physical Capital: the direct benefits to physical health and positive influences on healthy behaviours (see, for example, Ekelund et al., 2019);
2. Emotional Capital: the psychological and mental health benefits associated with physical activity (see Eime et al., 2013);
3. Individual Capital: the elements of a person's character—e.g., life skills, interpersonal skills, values—that accrue through participation in physically active play, sports and other forms of physical activity (see Cope et al., 2017);
4. Social Capital: the outcomes that arise when networks between people, groups, organisations, and civil society are strengthened because of participation in group-based physical activity, play, or competitive sports (Bangsbo et al., 2016);
5. Intellectual Capital: the cognitive and educational gains that are increasingly linked to participation in physical activity (Bailey, 2017);
6. Financial Capital: Gains in terms of earning power, job performance, productivity and job attainment, alongside reduced costs of health care and absenteeism/presenteeism (i.e., lower productivity among those who are "present") linked to physical activity.

In other words, physical activity does not just improve physical health; it leads to improved functioning of the whole person and enhanced well-being. Inactivity, in contrast, leads to reduced and impoverished functioning, and ill-being.

The case for regular physical activity is even more compelling for children with disabilities than the general population as, in addition to the benefits and costs summarised above, regular participation in physical activity significantly reduces health complications secondary to disability conditions (Rimmer et al., 2012). Of course, disability is a broad and often ill-defined label, and its impact on physical activity varies with the nature of the condition, the interaction between conditions and contextual factors, and (as discussed earlier) the personal characteristics of individual children (Ng et al., 2017). Some disabilities directly affect children's capacity to move, such as developmental coordination disorder and cerebral palsy, while others indirectly interfere with movement, due to sensory or cognitive impairment (Sugden & Wade, 2013).

Research suggests that children with VI are less likely to meet guidelines for physical activity and tend to be more sedentary than their peers without VI (Augestad & Alsnes, 2020; Haegele, Aigner, & Healy, 2019). For example, a Norwegian study compared the physical activity patterns of adolescents reporting no impairment with those reporting severe VI (Brunes, Flanders & Augestad, 2015). Activity levels were low for both groups, but while 32% of the adolescents without VI participated in physical activity on four or more days a week, the figure was only 15% for their peers with severe VI. Also, 13% of the young people with normal vision and 24% of those with severe VI reported less than one hour of weekly physical activity.

Due to limited PA opportunities and inactivity, children with VI exhibit low levels of health-related fitness (Lieberman et al., 2010), which puts them at greater risk for non-communicable diseases (Augestad & Jiang, 2015). The adverse effects of obesity on health have been the focus of considerable research interest in recent years (Lee & Yoon, 2018). Overweight children are more likely to become overweight adults and have a greater risk of obesity in adulthood than normal-weight children (Rundle et al., 2020). Children with VI are more likely to have higher levels of body fat (Bener et al., 2011) and higher body mass index (Yang et al., 2016) than those without VI. In addition to the general health consequences of being overweight, in severe cases, obesity in children with VI can lead to other diseases that further cause eye diseases (Cheung & Wong, 2007). In addition to a posited role for perceived and actual motor competence (which will be discussed shortly), several factors have been identified as influencing the generally low levels of physical activity among children with VI:

1. Access to appropriate equipment (Conroy, 2012);
2. Parental awareness of physical activity opportunities, and how to support them (Perkins et al., 2013)
3. Professional education of providers of programmes (Haegele & Kirk, 2018);
4. Placement in specialist VI-based educational settings (Haegele et al., 2017).

Young children with VI have been reported to have distinctive difficulties acquiring and practising rudimentary motor skills, and, according to all the models of motor development discussed earlier in this report, these difficulties are likely to carry over and become worsened in later childhood and adolescence if it is not addressed through appropriate interventions (Haegele, 2020). Consequently, it is predicted that children with VI are at heightened risk of physical inactivity, and concomitant health risks. However, the research into the variables affecting the physical activity of children with VI suggests that adapting the context and quality of the physical activity experienced offered to children with VI will positively affect their levels of activity. However, as several commentators caution, further research is needed to adequately determine the most effective strategies for promoting physical activity among children and young people with VI (Augestad & Alsnes, 2020).

The next section reviews the available literature describing the physical activity patterns of children with VI. In subsequent sections, reviews will focus on other themes discussed in the earlier sections, focused on the variables associated with the motor competence and perceived motor competence of children with VI.

Review: Physical Activity and Children with VI

This section addresses two related questions:

1. what is known of the physical activity of school-aged CYP-VI?
2. what are the correlates of physical activity school-aged CYP-VI?

The first set of analyses related to the physical activity levels of CYP-VI. It has two parts: the first reports on the published reviews of the literature on this topic; the second summarises individual empirical studies.

Reviews are useful starting points when investigating themes like this as they present a useful overview of the available evidence at the time of the review. In this case, the method employed in this, and subsequent sections was 'Rapid Reviewing', in which relevant sources for this and subsequent sections were identified using an adapted and simplified systematic reviewing approach. This method was judged to be best suited to the needs of this investigation. However, by the nature of reviews, discussion of individual studies is necessarily limited. For this reason, findings from such individual studies are also presented and discussed.

Three literature reviews were found (Augestad & Jiang, 2015; Haegele & Porretta, 2015; Li, Kuang & Qi, 2020). They followed broadly similar approaches, following the PRISMA methodology for reporting reviewing (Moher et al., 2009). Details of the systematic reviews are presented in Table 2.

Table 2: *Systematic reviews of literature on physical activity and CYP-VI*

Source	Objective	Date range / Age range	Included studies	Findings
Augestad & Jiang (2015)	To evaluate current evidence-based knowledge about physical activity, physical fitness, and body composition among children and young adults with visual impairments	January 1984 - April 2014 Aged 5–22years	29 publications met the inclusion criteria 6 interventional studies; 23 observational studies with a cross-sectional design.	In general, the findings revealed lower levels of participation in physical activity, poorer physical fitness, and a higher prevalence of overweight and obesity among children with VI compared to children with no reported VI. Lack of longitudinal observational studies and randomised clinical trials reduced the possibilities to draw cause-effect conclusions. However, the cross-sectional studies confirmed that young adults with VI may need more physical activity to become fitter and have a healthier body composition. Furthermore, low physical activity may influence higher prevalence of overweight and obesity among children and young adults with vision loss.

Haegele & Porretta (2015)	To review published research literature on physical activity for school-age individuals with visual impairments by describing study characteristics and major findings	January 1982 - June 2013. School-age (<22 years)	18 articles met all inclusion criteria. 5 descriptive studies; 6 correlational studies; 7 interventions studies.	Major findings suggest that low physical activity levels of school-age individuals with VI may be related to perceived participation barriers including the availability of appropriate opportunities rather than visual acuity or educational setting.
Li, Kuang & Qi (2020)	To systematically summarise the existing literature, which investigated the correlates of physical activity of children and adolescents with VI and identify variables that contribute to their physical activity participation	<2019 Aged 5 to 17 years	17 articles identified correlates of physical activity in children and adolescents with VI	Out of 21 variables identified from the reviewed studies, 3 were consistently associated with physical activity of children and adolescents with VI. Body mass index/obesity, percentage of body fat, and visual impairment level were consistently and negatively associated with physical activity of children and adolescents with VI. Gender and age were identified as having inconsistent relationships with physical activity in children and adolescents with VI. The level of parental education was identified to have “no association” with children and adolescents with VI.

16 empirical studies were found that addressed the two questions given above. These articles varied to some extent in scope and focus, but all provided evidence on

relationships between physical activity and VI in childhood and/or adolescence. These studies are summarised in Table 3.

Table 3: *Empirical studies examining the physical activity levels of CYP-VI*

Source	Objective	Sample / Visual Impairment	Type of Study / Measures	Findings
Aslan, Calik & Kiti (2012)	To determine physical activity levels of visually impaired children and adolescents and to investigate the effect of gender and level of vision on physical activity level in visually impaired children and adolescents.	30 visually impaired children and adolescents; 19 boys, 11 girls). Between 8 and 16 years. 16 low vision, 14 blind	Correlational Diary, 1-mile run/walk test	Significant relationships were reported for light and moderate PA in boys over girls with low vision. No significant relationship was reported between gender and endurance. Low physical activity levels were reported for all children and adolescents with VI.
Ayvazoglu, Oh & Kozub (2006)	To explore physical activity in children with visual impairments from a family perspective.	2 boys, 4 girls. Age 6–14 years. 2 B1, 1 B2, 3 B3[1]	Correlational Accelerometer & interview	Parents reported transportation, family member involvement, safety, and time as variables that influence their child's PA levels. Participants indicated a desire to learn sports that can be used outside of school settings. Varying correlations were reported between activity levels of children with VI and siblings.

[1] United States Association of Blind Athletes vision-classification system.

Cervantes & Porretta (2013)	To examine the impact of an after school physical activity intervention on adolescents with VI within the context of Social Cognitive Theory.	3 males, 1 female. Aged 14–19. 2 B1, 1 B2, 3 B3[1]	Intervention Accelerometers & questionnaire	Socio-cognitive intervention resulted in increased leisure-time physical activity for students in school for the blind. Positive changes were reported in social-cognitive construct scores.
Giese, Teigland & Giessing (2017)	To compare levels of physical activity, body composition values, and emotional well-being of school-age children and youths with VI in specialised schools with those of sighted children in mainstream schools.	115 children with VI; 118 sighted children. Visual acuity of 0.3 or less in the better eye with best possible correction	Correlational Pedometers, bioelectrical impedance analysis, and the WHO-Five Well-being Index	In all relevant parameters, students with VI achieved results comparable to those of sighted students, and the degree of VI did not correlate significantly with the parameters. The results confirm the positive effects and the importance of physical activity for students with VI. High levels of physical activity are possible which provide health-related benefits for children and youths with VI.
Greguol, Gobbi & Carraro (2014)	To analyse the practice of physical activity among children and adolescents with VI, regarding the possible influence of parental support and	22 young people with VI (10+2.74 years old) and one of each of their parents.	Descriptive Physical Activity Questionnaire for Older Children (PAQ-C), Baecke Questionnaire, the Parental Support Scale and a questionnaire about perceived	Blind young people showed lower physical activity levels. There were significant correlations both between parents' physical activity and the support offered to children and between the PAQ-C results and the importance given by young people to physical activity, but only for those aged between 8 and 10

	perceived barriers.		barriers to physical activity.	years old. The main perceived barriers were lack of security, motivation, professional training and information about available physical activity programs.
Grønmo & Augestad (2000)	To evaluate differences between the levels of physical activity of two groups (to determine whether the amount of physical activity affects youth physical and social self-concept, and global self-worth.	104 (20 of whom were blind). Aged 13–16 years	Correlational Survey, Eurofit, skinfold callipers	Significant differences were found between students who were blind and students without VI in school and community physical activity. No difference was found in affective variables between students in specialised and integrated schools.
Kozub (2006)	To explore differences in free-time motivation scores between adolescents with VI from a residential setting who are at criterion levels of body mass indexes and their fellow students who score outside the healthy zones.	20 males, 11 females. Aged 12–21 years Vision deficits that affect educational performanc e	Correlational Motivation score, minutes of physical activity, body mass index	No difference between groups was found in final motivation/amotivatio n sub-scales. After-school programmes offered moderate PA. No PA difference was found between those with high compared with low body-mass index. Low daily PA counts were found for all participants.
Kozub & Oh (2004)	To investigate activity patterns in	10 males, 9 females.	Correlational Accelerometer s	Significant differences in bouts of moderate to vigorous physical

	students attending a state school for the blind.	Ages 5-18 years low vision, high vision, blind		activity were not found between gender, resident type, body-mass index, or VI level. A significant difference was found in MVPA between VI and peers without VI. An inverse relationship was found between age and MVPA.
Kroksmark & Nordell (2001)	To explore how four adolescents with low vision and two sighted adolescents spent their leisure time and whether their everyday activities were bound to places or people.	4 low vision, 2 sighted. Aged 15–16 years. Visual acuity of children with VI ranged from 0.1 to 0.3.	Descriptive Diary entries	According to the diaries they kept the adolescents with low vision performed fewer activities than the sighted adolescents, did not regularly spend much time with friends, and seemed to be dependent on their parents for transportation.
Lieberman et al. (2006)	To determine the effects of using a talking pedometer on walking behaviour and the value placed on walking by children who are visually impaired or deaf-blind.	15 boys, 7 girls. Aged 9–13 years 4 B1, 9 B2, 9 B3[1]	Intervention Talking pedometers, interviews	Camp participants reported a preference for talking pedometer is for physical activity. Total pedometer steps increased during camp.
Longmuir & Bar-Or (2000)	To examine gender, disability type, age, and specific diagnostic category in	987 young people (458 girls and 499 boys). Aged 6 to 20 years (M = 12.89).	Correlational Mailed survey	For children with VI, there was low habitual physical activity and perceived fitness, and high activity limitations. Disability types affected physical

	relation to habitual physical activity levels, perceived fitness, and perceived participation limitations of youths.	educe visual acuity or the visual field (e.g., partial or total loss of sight), n = 77		activity, perceived fitness, and activity limitations. There was no influence of gender or age on the results.
Oh, Ozturk & Kozub (2004)	To identify relationships between social engagement and physical activity in school-age children who attend a school for the blind.	19 students, 9 males, 10 females. Aged 6–18 years 3 blind, 4 low vision, 12 high vision, no other impairment s	Correlational Survey	Physical activity levels were found to decrease with age. A relationship was found between age and social engagement, but not a significant correlation. Youth vision level was not related to social engagement or PA.
Schedlin, Lieberman , Houston-Wilson & Cruz (2012)	To determine the amount of time participants were appropriately engaged in activity in both closed and open sport units.	1 male, 1 female. Aged 15 years Male 20/100, female 20/600	Descriptive Questionnaire	Lower physical activity time reported for the male with low vision then for the female without vision. Male with low vision had less PA time than sighted peers.
Sit et al. (2007)	To examine the physical activity of children with disabilities during physical education and recess while simultaneousl y documenting environmenta l conditions.	172 children enrolled in grades 4 to 6 in five special education schools (35 with VI).	Correlational System for Observing Fitness Instruction Time (SOFIT)	Children accrued little moderate-to-vigorous physical activity during physical education (7.8 min) and recess (8.9 min). Activity levels varied across disability types, with differences attributed to lesson context and teacher behaviour. Children with physical disabilities were the

				least active during both PE and recess.
Smith et al. (2019)	To compare levels of physical activity and sedentary time in a representative sample of adolescents and adults with and without VI.	6001 participants (adolescents n=1766)	Correlational Accelerometers	Adolescents with uncorrected refractive error and non-refractive VI did not accumulate higher levels of sedentary time or lower levels of moderate-to-vigorous physical activity compared with those with normal vision.
Wiskochil et al. (2007)	To examine the effect of trained peer tutors on the academic learning time–physical education scores of children with VI.	2 males, 2 females. Aged 8–17 years	2 with VI, 2 completely blind	Trained peer tutors were effective in increasing physical activity time for individuals With VI in both open and closed activities.

That none of the reviews were able to identify longitudinal studies should lead to some caution in extrapolating from correlation to causation. The defining feature of cross-sectional studies is that they can compare different individuals or groups at a single point in time, rather like a snapshot. Longitudinal studies, in contrast, involve several periods of data-gathering of the same subjects over time. As a result, they can establish sequences of events. The absence of these types of studies in the evidence base suggests that further research is needed to fully understand the factors that cause changes to children with VI's physical activity.

Nevertheless, certain shared themes emerge from the reviews and studies. The most confident finding is that, in general, there are lower levels of physical activity among children with VI compared to their sighted peers (Aslan et al., 2012; Giese, Teigland & Giessing, 2017; Greguol, Gobbi & Carraro, 2014; Grønmo & Augestad, 2000; Kozub & Oh, 2004; Longmuir & Bar-Or, 2000; Smith et al., 2019). Those who are blind or who have low vision are less likely to meet guidelines for physical activity and tend to be more sedentary than their peers without disabilities. This was the conclusion of all three reviews, which also suggested that there was a negative correlation between physical activity levels and severity of VI. The reviews also reported negative findings in terms of other aspects of children's well-being, including "poorer physical fitness, and higher prevalence of overweight and obesity" (Augestad & Jiang, 2015: 178). For example, research has shown that up to 80% of children with VI do not reach standards for health-related physical fitness (Lieberman et al., 2010; Lieberman et al., 2006). Likewise, Lieberman et al. (2010) found only 34.9% of their sample of children within the healthy range of body mass index.

The relationships among physical activity, fitness, and obesity are well-established in the general literature (Collins & Staples, 2017), although the directions of causation are still not fully understood (Kohl, Murray, & Salvo, 2019). However, physical activity seems to have a positive influence on the physical and mental health, and overall quality of life of children with VI (Brunes, Flanders & Augestad, 2015), so these findings are cause for concern. It has been suggested that children with VI are less fit mainly because of inactivity (Longmuir & Bar-Or, 2000). It is also suggested that inactivity might partly lead to the increased likelihood of overweight and obesity among children with VI (Lieberman & McHugh, 2001).

There are numerous reasons why children and adolescents with VI may not engage in sufficient levels of physical activity. Several studies suggested that the physical activity levels of children with VI may be related to a lack of opportunity to participate, as well as a lack of appropriate teacher or coach education (Houwen et al., 2009; Kozub & Oh, 2004). Other factors that may be associated with the opportunity to be active include awareness of other individuals with VI and access to suitable physical activity programmes in the local community (Augestad & Jiang, 2015; Haegele & Porretta, 2015). Parents and other family members may also play a role in encouraging children with VI to participate in physical activity and sports (Ayvazoglu, Oh & Kozub, 2006).

These findings are significant as they suggest that low levels of physical activity among children with VI are not inevitable and can be addressed through appropriate interventions. Indeed, some studies' results showed that children with VI can be as active as their sighted peers if they are offered adequate opportunity to participate in appropriate programmes for physical activity and can develop their motivation to be active (Cervantes & Porretta, 2013; Lieberman et al., 2006). Lieberman and colleagues (2010) went as far as to claim,

> *"This problem can be avoided because children with visual impairments are born with the potential to achieve a healthy level of physical fitness. Many children with visual impairments are not given opportunities to participate in physical activities because of limited expectations for their performance." (p. 351)*

Another important finding from the reviews and empirical studies was the low number of physical activity interventions targeting school-age individuals with visual impairments (Haegele & Porretta, 2015). The limited number of intervention studies (e.g., Cervantes & Porretta, 2013; Lieberman et al., 2006) support claims that appropriately devised programmes for children and young people with VI can positively impact of their levels of physical activity. Haegele & Porretta (2015) hypothesise that the limited number of intervention studies may be the difficulty in obtaining an appropriate number of participants. Most studies in the reviews included small and convenience samples (non-probability sampling method where the sample is taken from a group of people who are easy to reach), such as from sport camps or residential schools for students with VI (e.g., Lieberman et al., 2006; Grønmo & Augestad, 2000), which is likely to restrict the available number of participants in research projects. Haegele & Porretta (2015) plausibly argue that, in light of the progressive movement towards inclusion in both sport and education, there is a need for more research with children with VI is mainstream settings.

Review: Motor Competence of CYP-VI

Analysis was also carried out on themes more narrowly focused on the central issue in this report, motor competence. As defined in the Introduction, motor competence is the ability to execute a wide range of motor acts in a proficient manner, including coordination of motor skills that are necessary to manage everyday tasks, such as walking, running, jumping, catching, throwing, kicking, and rolling (Barnett et al., 2016). What follows are three sets of analyses. The first part reports on the published literature on the development of motor competence in children with VI; the second summarises evidence related to the variables associated with these children's motor competence; and the third discusses the limited evidence on perceived motor competence. As will become apparent in the following discussion, the boundaries between these sets are permeable, and findings from one area connect with the others.

Two systematic reviews were found (Houwen et al., 2009; Haegele, Brian & Goodway, 2015). The Haegele, et al (2015) study focused on the development of fundamental motor skills for school-aged children with VI, so it relates to the first set of analysis. Houwen et al. (2009) review examined variables related to motor competence and relates to the second set. No reviews were located for the third set. As with the reviews discussed in the previous section, these reviews followed following the PRISMA methodology for reporting reviewing, albeit for different research questions. Table 4 summarises the two reviews and is followed by Table 4, about children with VI's motor competence.

Table 4: *Systematic reviews of perceived and actual motor competence of CYP-VI*

Source	Objective	Date range / Age range	Included studies	Findings
Houwen et al. (2009)	To review studies on variables that are related to the motor skill performance of children and adolescents with VI	Until February 2008. Children and adolescents ages 4 to 18 years.	26 studies examining variables associated with motor skill performance in children and adolescents with VI and 13 articles that reported	Weak evidence was found for three relationships: (a) between the degree of VI and dynamic balance and manual dexterity, (b) between amblyopia strabismus and fine motor skills, and (c) between movement interventions and motor skill performance. Also, weak evidence was found to refute a relationship

			suggestions by experts about variables related to motor skill performance.	between gender and static balance.
Haegele, Brian, & Goodway, 2015	To review the published research literature on fundamental motor skills for school-aged individuals with VI	Between 1982 and 2014 School-aged (<22 years) participants whose primary disability was VI or blindness.	Eleven articles were identified with all inclusion criteria.	This review found evidence to support delays in fundamental motor skills competence areas, including object control and balance skills. Mixed results were found while comparing students with VI to typically developing peers in regard to locomotor movements.

Table 5: *Empirical studies of motor competence of CYP-VI*

Source	Objective	Sample / VI	Interventions / Measures	Findings
Bouchard & Tétreault (2000)	To compare motor development of children with low vision to sighted children, and identify factors that influence motor development	60 children, 30 identified with moderate low vision, 30 sighted. 42 boys, 18 girls; ages 8-13. Moderate low vision	Comparative Bruininks Oseretsky Motor Proficiency Test	Low scores on six out of the eight tests for the low-vision group. Balance was the motor skill most affected by low vision. No difference was found between older and younger children with low vision.
Brambring (2006)		2 boys, 2 girls. Aged 4–6 years.	Comparative Bielefeld Observation Scale	Participants with VI had significant delays in comparison to

		3 completely blind, 1 light perception.		those without VI in areas of (a) dynamic balance, (b) acquisition of locomotion, and (c) refinement of locomotion
Caputo et al. (2007)	To investigate perceptual-motor and motor coordination abilities of children with strabismus (a condition in which the eyes do not properly align with each other when looking at an object)	32 children, 19 with strabismus. 29 boys, 13 girls, aged 4-6 years Congenital strabismus	Correlational Movement ABC	Children with strabismus Scored significantly lower than controls on Movement ABC and manual dexterity test.
Celano et al. (2016)	To assess motor functioning in 4.5-year-olds, and to determine contributions of visual acuity and stereopsis to measured motor skills	114 children Unilateral congenital cataracts	Comparative Movement ABC-2	The mean total score was low compared to the normative reference group. Motor functioning was not related to visual acuity in the treated eye or intraocular difference but was predicted in a regression model by the better visual acuity of either eye (usually the fellow eye). Children with unilateral congenital cataract may have delayed motor functioning at 4.5 years, which may

				adversely affect their social and academic functioning.
Fotiadou et al. (2014)	To evaluate and investigate the relationship between motor development and self-esteem in children and adolescents only with VI and no other impairment, and in children and adolescents with typical development	22 male, 15 female; aged 8–14 years 19 total vision loss, 18 partial vision loss	Correlational Bruininks Oseretsky Motor Proficiency Test	The scores on motor development and self-esteem of children and adolescents with VI were lower compared to those of the typical participants. Also, the results indicated an interaction between motor development and self-esteem in visually impaired participants.
Giese & Herrmann (2020)	To compare the basic motor competencies of adolescents with VI with those of their sighted peers	29 students with VI (mean age: 13.08 years) with sighted children, randomly pair-matched according to age and gender Visual acuity between 0.3 and 0.05 in the better eye = 41.4%; visual acuity between 0.05 and 0.002 in the better eye =	Comparative MOBAK-5-6 test	Basic motor competence of children with VI differed significantly from those of sighted children. On the overall value for ‘self-movement’, there was a significant difference between visually impaired and non-visually impaired children. The differences were greatest on the MOBAK test item ‘balancing’. From the perspective of social inclusion theory, these

		21.1%; visual acuity of 0.02 or less in the better eye = 34.5%		findings support the assumption that students with VI may be at particular risk of being excluded in the context of exercise, play, and sports.
Häkkinen et al. (2006)	To compare the neuromuscular function and balance of blind prepuberty- and puberty-aged boys to those with normal sight	33 pre-pubertal (aged 9–13 y) and pubertal (aged 15–18 y) blind and sighted boys Blind	Comparative Tests for muscle mass thickness, electromyography and maximal isometric strength, dynamic explosive actions, and balance.	Results showed comparable performance between pre-pubertal and pubertal blind and sighted boys in the static physical fitness tests. However, balance and performance in dynamic multi-joint tests did not improve similarly in the blind groups compared to sighted groups, indicating that maturation, learning and experience by themselves cannot compensate for the loss of sight.
Hallemans et al. (2011)	To describe the age-related changes in gait in individuals with low vision and blindness.	40 children (3-11 years); 21 boys, 19 girls Congenital disorders of the peripheral visual system	Correlational Observed walking task	Differences between groups were a slower walking speed, a shorter stride length, a prolonged duration of stance and double support in the individuals with a VI. These may be considered either as adaptations to

				balance problems or as strategies to allow to foot to probe the ground.
Houwen et al. (2007)	To examine the performance of children with VI aged on different types of motor skills.	48 children with VI (32 boys, 16 girls. Mean age 8.10 years Variety of VI, including Retina, Nystagmus causes	Comparative Movement ABC	Children with VI showed poor Performance on five out of eight items of Movement ABC. No significant difference between children with moderate and severe VI, except for bi-manual coordination in 7-8-year-olds and eye-hand coordination in both age groups, favouring children with moderate VI.
Houwen (2010)	To compare motor skills and physical fitness of school-age children with VI and sighted peers	46 males, 29 females; aged 6–12 years Severe VI	Comparative TGMD-2 and Eurofit	Compared to their sighted peers, the children with VI scored lower on the locomotor and object control skills, and the physical fitness (Eurofit). Their body mass and body fat indexes were inversely correlated with the standing broad jump and the 20-metre shuttle run but positively correlated with handgrip strength. Moreover, significant inverse correlations were found between

				their locomotor and object control skills on the one hand and plate tapping and the 5 × 10-m shuttle run on the other hand.
Hrisos et al. (2006)	To investigate the influence of visual acuity and stereo-acuity on the performance of preschool children on tasks requiring visuomotor skills and visuospatial ability.	50 children (mean age 5.7 months; VA: 6/9 (6/6 to 6/60).	Correlational Test battery composed of items from several existing packages	Stereoacuity, but not impaired visual acuity, predicted performance on eye-hand coordination and visuo-motor integration tasks.
Pineio et al. (2019)	To evaluate motor development and adaptive behaviour of visually impaired children and adolescents without any other disability, aged 6-14 years old	37 children and adolescents with VI and 37 children and adolescents without VI, aged 6-14 years old	Comparative Bruininks Oseretsky Motor Proficiency Test & Teacher Rating Scale	The performance of visually impaired children and adolescents in terms of their motor development and adaptive behaviour was lower than that of their peers. At the same time, convergence was found between the variables motor development and adaptive behaviour of children and adolescents with VI.
Reimer et al. (2008)	To investigate potential differences in motor control between	11 children with VI (mean age 8.4 years, 7 boys, 4	Comparative Children performed two types of movements	Children with VI displayed larger endpoint variability. Discrete movements and

	children with a VI (diagnosed albinism) and children with normal vision	girls,); 11 children with normal vision (mean age 8.4 years); 6 boys, 5 girls	(discrete and cyclic) in two orientations (azimuthal and radial (i.e., along the viewing and lateral direction), and with two amplitudes (10 and 20cm). All movements were performed in two subsequent target conditions: with and without visual information on the target location.	movements over large distances were less fluent in both groups, but especially in the children with VI. Children with VI seemed to have more difficulties with calibrating the sensory information. Specifically, they made larger errors along the lateral direction when the target was not visible. Results suggest that children with VI have specific differences in motor control compared with children with normal vision, which are not all directly related to their poorer vision.
Wagner, Haibach & Lieberman (2013)		14 boys, 9 girls. Aged 6–12 years No light perception	Comparative TGMD-2	Children who are blind performed significantly worse than peers without VI in all assessed locomotor and object control areas.
Wyver & Livesey (2003)	To examine the relationship between kinaesthetic sensitivity and motor development of children with a	30 children, 11 with moderate VI, 4 with severe VI, and 15 sighted; 19 boys, 12 girls, aged	Comparative Movement ABC, Kinaesthetic Sensitivity Test, and Manual Placement Test	Children with moderate VI had poorer scores on static and dynamic balance then cited peers. Children with severe VI had poorer movement ABC and KST

	congenital VI resulting in partial vision or severe VI	6-12 years olds Congenital VI resulting in partial vision or severe VI		scores than sighted children.

Table 6: *Studies examining variables associated with motor competence in CYP-VI*

Source	Objective	Sample / VI	Interventions / Measures	Findings
Aki et al. (2007)	To study the effectiveness of a motor training programme for visually impaired children	40 children with VI took part in the study. 20 children (10 boys, 10 girls), mean age 8:9, were in a Training group and 20 children (10 boys, 10 girls), mean age 8:10 were in a Home Training group. Low vision.	Correlational TGMD-2, use of colourful equipment, high contrast materials, additional instruction.	Training programme included training balance control, coordination, strength, visuomotor, and finger dexterity. Significant differences were found on all skills after training in the Training group, but no significant differences were observed, other than visual-motor control, in the Home Training group. Children with low vision have some useable vision and learning to use the available vision depends on proper rehabilitation.
Engel-Yeger, 2008	To evaluates gross motor abilities and self-perception about	22 children with VI, and 25 children with normal	Comparative Movement ABC	Amblyopia may negatively impact children's motor abilities as expressed by the objective measures in daily living, while self-

	physical abilities of pre-school children with amblyopia (lazy eye), in comparison to their unaffected peers	vision, aged 4-7. Amblyopia		perception is less affected. Amblyopic children performed significantly worse than controls according to the Movement ABC parent questionnaire. In the scale of perceived competence evaluation, the amblyopic children had lower scores in half of the items as well as in the total mean score, but the differences between the groups were not significant.
Haibach, Wagner & Lieberman (2014)	To examine the influence of age, sex, and severity of VI upon locomotor and object control skills in children with VI.	100 children with VI, aged 6 12 years (mean age = 9.97 years). 61 boys, 39 girls. 23 B1, 25 B2, 52 B3	TGMD-2	Age and sex did not play an important role in most of the skills, except boys out-performing girls striking, dribbling, and throwing, and older children out-performing younger children in dribbling. The significant impact of the severity of VI is likely due to decreased experiences and opportunities for children with more severe VI. Also, these reduced experiences likely explain the lack of age-related differences in the children VI.

Haegele, Brian, & Goodway (2015) found evidence of delays in fundamental motor skills, object control and balance skills. However, there were mixed results comparing children with VI with their sighted peers regarding locomotor skills, with two studies reporting significant differences between those with VI and those without (Houwen, Hartman & Visscher, 2010; Wagner, Haibach & Lieberman, 2013) and one study not (Houwen et al., 2007). Furthermore, individuals with VI were found to demonstrate delays in the acquisition of locomotor skills, such as walking independently, and walking up and down stairs (Brambring, 2006; Levtzion-Korach et al., 2000). It was also found that children with severe impairments tend to perform significantly worse with fundamental movement skills than those with less restrictive VI (Haibach, Wagner & Lieberman, 2014).

Most studies included in the review by Haegele, Brian, & Goodway (2015) examining the motor skills of children with VI concerned itself with exploring differences in skills when compared to their sighted peers. Children with VI almost always exhibited lower levels of motor competence than those without VI. These findings were consistent across different domains of manipulative skills (Wagner, Haibach & Lieberman, 2013), locomotor skills (Houwen, Hartman & Visscher, 2010), and stability skills (Haibach, Lieberman, & Pritchett, 2011). There is also a positive linear relationship between gross motor skills and degree of vision, so, as the degree of vision increases so does the level of motor competence (Brian, 2020). There is some evidence that children with VI acquire motor skills later than those without VI (Haegele, Brian, & Goodway, 2015). However, more recent studies suggest that young people may not ever achieve the same degree of motor competence as those without VI (e.g., Brian et al., 2018). Significantly, differences in fundamental motor skills were not apparent for older children compared to younger children (Brian et al., 2018) and differences based upon biological sex rarely occur (Haibach, Wagner & Lieberman, 2014).

While children with VI have greater difficulties with motor competence than their sighted peers, it is less clear why these disparities exist (Brian, 2020). As discussed earlier in this report, it seems reasonable that children without vision or with low levels of vision are adversely affected by a lack of visual information from the environment, which will disadvantage them in the acquisition and practice of motor skills. Severe motor developmental delays tend not to be corrected over time, but with the exception of the degree of vision, environmental and functional constraints seem to have a stronger impact on motor competence than variables such as biological sex and age (Brian, 2020). Figure 8 summarises the main variables discovered from the reviews and empirical studies.

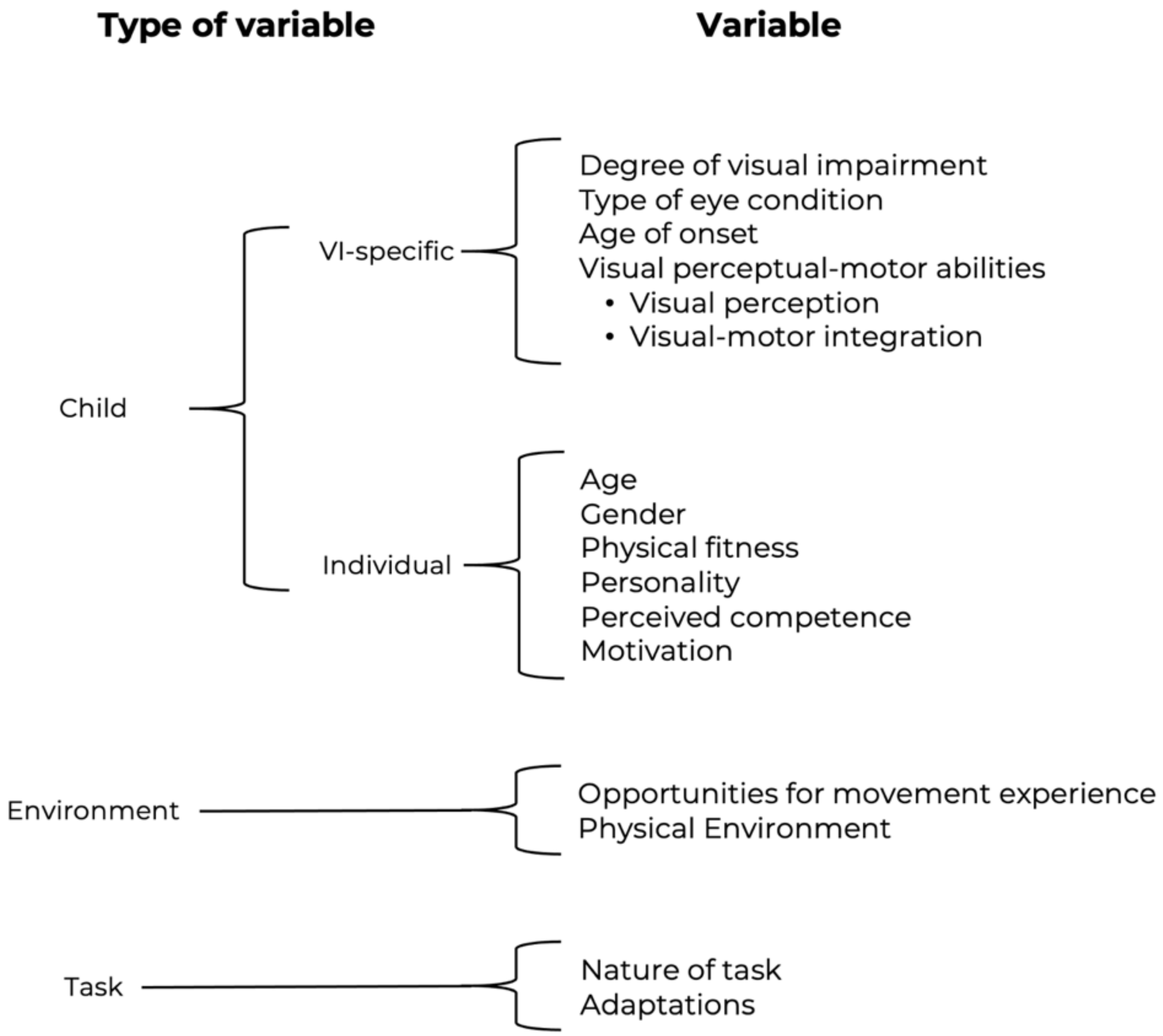


Figure 8: *Possible Variables Explaining Motor Skill Performance of CYP-VI*

The final set of analysis addresses the question of the impact of perceived motor competence. This is a notably under-researched area, as is evident in the table below, with only four identified studies by the same research team (Table 7). Nevertheless, as the earlier discussion of models of motor development demonstrate, perceived motor competence is a topic worthy of consideration.

Table 7: *Studies examining variables associated with perceived motor competence of CYP-VI*

Source	Objective	Sample / Visual Impairment	Interventions / Measures	Findings
Brian, Haegele & Bostick (2016)	To examine the association between VI level and perceived motor competence scores for, and the association between perceived motor competence and physical activity	15 children (10 girls, 5 boys), aged 3–13 B1=5, B2=3, B3=4, & B4=3	Perceived Physical Competence (PPC) Subscale of the Pictorial Scale for Perceived Competence and Social Acceptance (PSPCSA); Perceived Athletic Competence Subscale of the Self-Perception Profiles for Children (SPPC); self-report for physical activity.	A positive association was reported between the level of VI and perceived motor competence and a negative, non-significant association between age and perceived motor competence. For participants aged 8–13, perceived motor competence was positively associated with moderate to vigorous physical activity, while age was negatively associated with moderate to vigorous physical activity. The findings suggest that children VI impairments tend to have low levels of perceived motor competence. For children ages 8–13, perceived motor competence relates with moderate to vigorous physical activity. As children age, a trend emerges that perceived motor competence and

				moderate to vigorous physical activity lowers.
Brian et al. (2018)	To examine the developmental trajectory of perceptions of motor competence of children ages 3 to 13 years, with and without visual impairments	35 children (20 girls, 15 boys, aged 3 to 13 years (mean age = 8.06) According to US Association of Blind Athletes system, B1=5 children; B2=3; B3=3; B4=4	PPC (sighted children 3-7-year-olds); Test of Perceived Motor Competence for Children with Visual Impairments (TPMC-VI) (children with VI, 3-7-year-olds); SPPC (children with and without VI, 8-13 years.	Children with VI reported low perceptions of motor competence. Also, children with VI had significantly lower perceptions of motor competence than did their sighted peers.
Brian et al. (2020)	To test whether perceived motor competence mediates the relationship between motor competence and physical activity for youth with VI	138 children; boys = 81, girls = 57. Aged 9–18 years (mean age = 13.37 years) with visual impairments B1 = 30, B2=28, B3=55, B4=25	TGMD-3, PPC-IV, and PAQ	Locomotor skills predicted perceived motor competence, which predicted physical activity. Perceived motor competence showed a mediation effect on the path from locomotor skills to physical activity. There was no significant relationship between locomotor skills and physical activity.

Children with VI not only have lower levels of actual motor competence but significantly lower levels of perceived motor competence when compared to sighted peers (Brian et al., 2018). Levels of perceived motor competence start lower and decrease with age (Brian et al., 2016). Brian (2020) suggested that the combination of low levels of perceived and actual motor competence may explain why there are neither sex-based not age-based differences in motor skills of children with VI. This is consistent with Stodden and colleagues' (2008) suggestion that perceived motor competence mediates the relationship between actual motor competence and physical activity behaviours. Only one study was found to address this claim directly (Brian et al., 2020). Researchers reported that perceived motor competence did mediate motor competence (especially regarding locomotor skills) and predicted physical activity behaviours in children with visual impairments. Perceived motor competence also significantly predicted the autonomous motivation for physical activity of children with VI (Brian et al., 2019).

This sort of information has important implications for those seeking to increase the opportunities of children with VI. But a note of caution needs to be sounded. Both groups of reviewers highlighted the lack of empirical research and poor methodological rigour in these areas. These were also concerns identified by Houwen et al. (2009), who noted the "inadequate evidence base from which to inform practical decision making" (p. 324). This raises concerns about the empirical base of policies and practices to support the motor competence of children with VI. So, the paucity of the empirical base in this area means that such claims ought to be considered hypotheses that need to be submitted to further tests, rather than findings.

Interventions

Theoretical Approaches

As has been stressed throughout the earlier parts of this report, movement takes place in a context and, therefore, context always needs to be considered in any practice or intervention. A common aspect of these practices and interventions involves others and situations in which different individuals plays different roles.

The best-known framework for thinking about these matters in probably Henderson, Sugden, & Barnett's (2007) 'Ecological Intervention' approach. It is useful here as it was explicitly created as a framework for thinking about interventions to support motor competence and address challenges associated with disability (Sugden & Wade, 2013). According to this framework, intervention outcomes are a function of the interaction of the individual's resources, the environmental context, and the manner of presentation of tasks to be learned. In other words, Ecological Interventions involves three main variables:

1. the environment in which movement takes place;
2. the resources of the individual; and
3. how movement tasks are experienced or presented (see Figure 9).

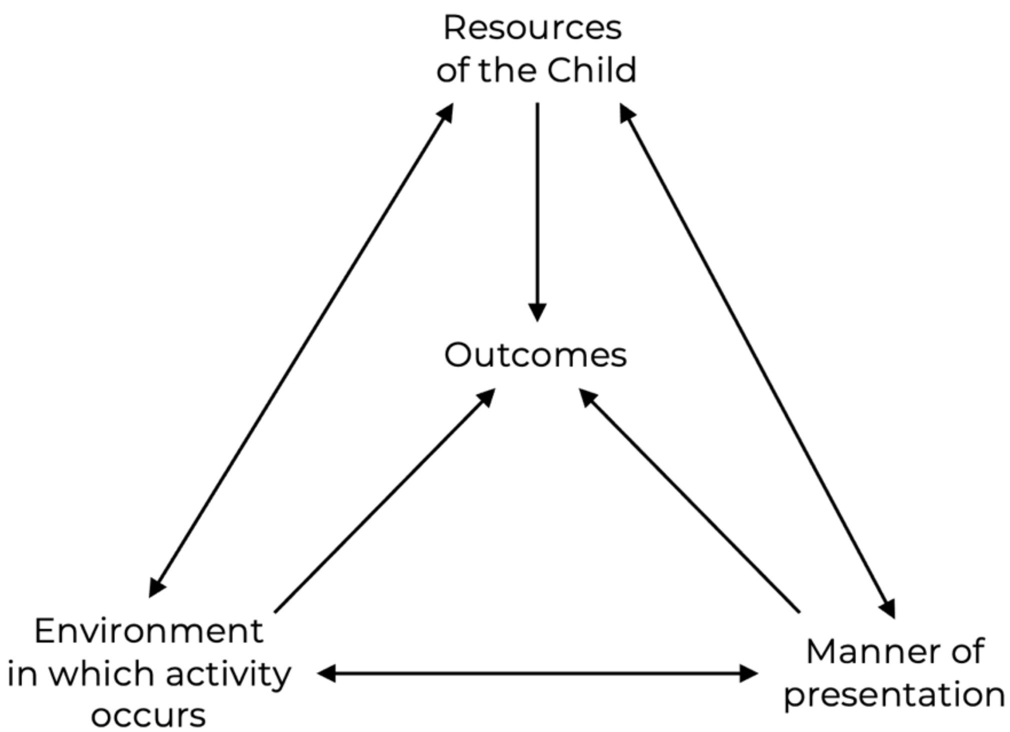


Figure 9: *Ecological Interventions*

The Ecological Interventions approach has been an influential framework for inclusive forms of assessment and pedagogy (e.g., Celano et al., 2016; Eddy et al., 2020; Pesce et al., 2016). It also usefully summarises what appears to be a general trajectory within the fields of Adapted Physical Activity and Inclusive Physical Education away from medicalised models of development and ability towards a greater acknowledgement of contextual and environmental factors in motor development (Haegele, Hodge, & Shapiro, 2020). As such the Ecological Interventions approach offers a theoretical basis for practically orientated models.

The best-known of these applied approaches is the 'Inclusion Spectrum' (Black & Stevenson, 2011).[2] As the name suggests, this is a tool for thinking about how to support all learners, including those with disabilities (Black & Williamson, 2011). The Spectrum utilises an inclusive design that enables teachers, coaches, and others working with learners to understand, within context, how to address the learning needs of each student (see Figure 10). In a similar way to some other approaches, such as Universal Design for Learning (Hartmann, 2015), the Inclusion Spectrum recognises the need to think proactively about the design and structure of the learning environment to ensure access for all but adds an emphasis on identifying barriers to participation and the design of meaningful lessons that allow learning goals to be achieved through a variety of task options and organisational strategies (Lieberman & Houston-Wilson, 2018).

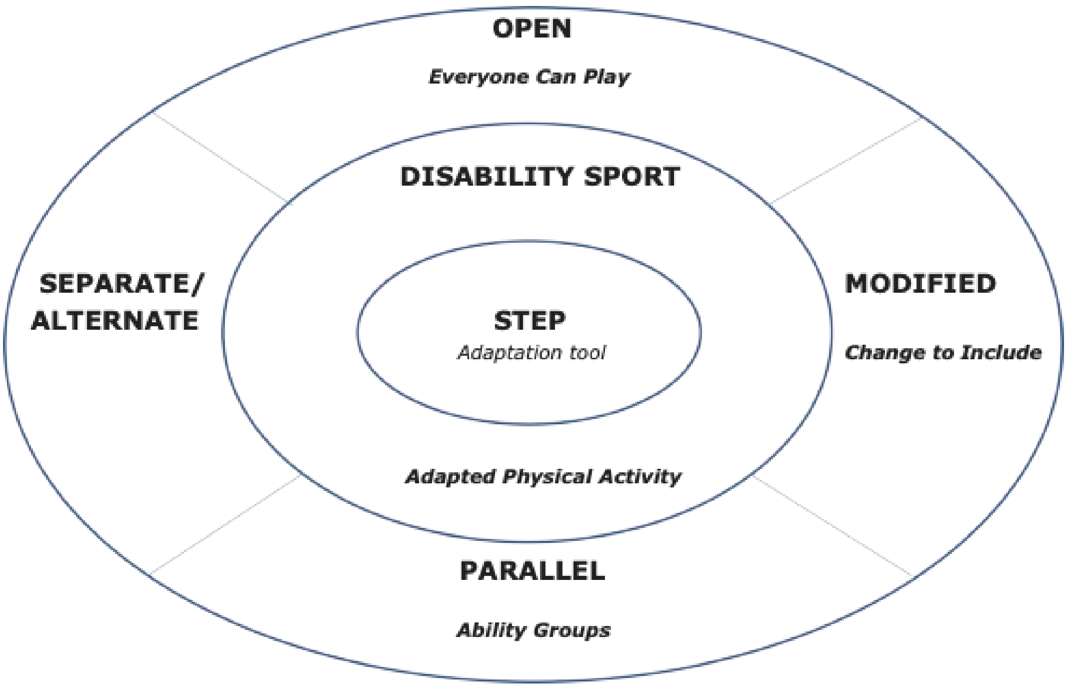


Figure 10: *The Inclusion Spectrum*

Source: *Black & Stevenson 2011*

[2] The graphic for the Inclusion Spectrum obviously does not represent a spectrum: Its name originated with earlier versions, which followed the lead of Winnick's (1990) classic text, where the instructional placements were located on a continuum. Black and Stevenson (2011) later changed the model from a hierarchical structure into an instructional tool for managing students and customising instruction according to the task parameters.

Table 8: Inclusion Spectrum

Inclusion Spectrum approach	Explanation
Open activities – Everyone can play	Everyone does the same activity with minimal or no adaptations to the environment or equipment; open activities are by their nature inclusive so that the activity suits every participant. For example, warm-up or cool down, and cooperative or unstructured movement games (like collecting games, play canopy games, or action songs and activities).
Modified activities – Change to include	Everyone plays the same game or performs the same activity, but adaptations based on aspects such as the rules, equipment or area of activity are employed to promote the inclusion of all individuals regardless of their abilities. For example, playing basketball with a variety of targets, such as a lowered basket, a hoop taped to the wall or a box on the floor so that participants choose to score in the target most-suited to their abilities.
Parallel activities – ability groups	Although participants follow a common activity theme, they do so at their own pace and level by working in groups based on their abilities. For example, two groups can play a seated and standing version of a game where participants access the version most suited to their abilities. Or in a net-wall game (like volleyball) participants, in three groups, play with no barrier, a low net, or a net at regulation height.
Separate/Alternate	These activities are purposely planned for individuals who require more involved motor skill development, or a specific context for participation. For example, some disabled students might benefit from focused instruction before joining an inclusive lesson. Or higher skilled leaners might be given support in specialised sports, such as Blind Sport.

Each of the five components of the spectrum interacts with and complements the others to provide an optimum environment for learning. So, there is a close parallel with Ecological Interventions, and the key variables encountered by the learner: the environment in which activities take place; and the manner of presentation. There is also a recognition of the value of peers of different stages of motor development to work together. Details of the different elements of the Inclusion Spectrum are presented in Table 8.

Table 9: *The STEP model*

STEP element	Generic change examples	VI-related example
Space	Change the size of the playing area; vary the distance to be covered in practices to suit different abilities or mobility levels.	Gradually increase the size of the playing area so children with VI can increase their scope of movement.
Task	Ensure that everyone has equal opportunity to participate (e.g., in a ball game, all the players have the chance to carry/dribble, pass or shoot).	Break down complex motor skills into smaller, achievable, component parts to help players more easily develop skills.
Equipment	In ball games, increase or decrease the size of the ball to suit the ability or age range of the players, or depending on the kind of skill being practised.	Introduce ball-handling skills with Pimple Balls (soft balls covered with elevated bumps) to maximise surface area for manipulation.
People	Balance team numbers according to the overall ability of the group (i.e., it may be preferable to play with teams of unequal numbers to facilitate inclusion of some players and maximise the participation of others).	Give players specific roles in a game that emphasise their abilities.

Source: *Adapted from Black (2011)*

These approaches to the organisation of lessons relate closely to the environmental dimension of Ecological Intervention. Task-related elements were also addressed by Black and his colleagues, in the form of the 'STEP' strategy. This is an acronym meaning **S**pace, **T**ask, **E**quipment and **P**eople. The claim here is these are four areas of any activity that can be adapted to make teaching and interventions more engaging for all learners (see Table 9). Alterations can be made in one or more areas, beginning with the aspects that seem to be creating the most issues (Black & Stevenson, 2011).

Empirical Findings

One systematic review was identified that addressed physical activity interventions for children and youth with VI (Furtado et al., 2015). The authors reported generally low-quality studies in this area, including the absence of quite basic content, such as information about participant characteristics and details of the interventions, themselves). An additional challenge is the paucity of valid and reliable outcome measures for CYP-VI. With these caveats in mind, the review found positive effects of both structured exercise training and leisure-time physical activity interventions in terms of enhanced levels of physical activity. For example, programmes found to be effective in promoting improved motor competence and physical fitness included basic movements like balance exercises (Jazi et al., 2012), and body coordination, visual motor control, finger dexterity (Aki et al., 2007), to more complex activities such as rope jumping (Chen & Lin, 2011), gymnastics (Hashemi, Khameneh & Salehian, 2015), traditional dance and Pilates (Mavrovouniotis et al., 2013). None of these studies led to the achievement of the 60-minute recommended target for daily physical activity, but they could, of course, contribute to the accumulation of that figure when combined with other forms of physical activity.

The review found several studies focusing on instructional strategies. Two studies reported that peer-tutoring programmes can increase activity levels during physical education classes (Wiskochil et al., 2007), although they involved very small samples (3 and 4 students, respectively). Other research examined the use of 'exergames' to promote the physical activity of children with VI (Boffoli et al., 2011;

Gasperetti et al., 2018). These studies found that video game-based technology has demonstrable benefits for CYP-VI and are viewed by these children as enjoyable contexts for being physically active.

The theoretical perspectives from Henderson, Sugden, & Barnett's (2007) and Black (2011) are consistent with empirical findings on the promotion of motor competence. For example, research with sighted populations strongly that children find outdoor environments stimulating and motivating (Niemistö et al., 2019), and value large spaces as settings to play and run (Harten et al., 2008). Such free movement and play are important experiences in the development of locomotor skills, such as walking, running, climbing, galloping, and jumping (Donnelly, Mueller, & Gallahue, 2016), and object control skills, such as holding, projecting, and receiving balls (Iivonen & Sääkslahti, 2014). The improvement of locomotor motor skills appears to be important for young children's overall development, as it provides increasing and more varied opportunities for social interactions and cognitively challenging experiences (Campos et al., 2000). Locomotor skills continue to play a pivotal role in development by facilitating new contexts for maintaining and updating existing skills. Such development is possible when children have the necessary social support and freedom to move in an environment with interesting opportunities. Object control skills open-up new opportunities for visual, manual, and oral exploration, which are foundational of coordination. The first form of FMS, stability skills, have tended to be over-looked by researchers, but there is little doubt that they play a key role in the development of motor competence by helping the learner to sense a shift in the relationship of the body parts that alter one's balance, as well as the ability to adjust rapidly and accurately to these changes with the appropriate compensating movements (Rudd et al., 2015). All these skills support children's motor competence, in a variety of settings, and effective interventions are likely to be those that facilitate their development.

So, it is cause for concern that empirical research has generally reported delayed development in the motor skills of children with VI (Brian, 2020). There is some evidence that appropriately designed interventions can positively affect the locomotor skills of children with VI (Brian et al., 2020). Another study examined the influence of a 7-day sports camp on the perceived motor competence of children and adolescents with VI (Brian et al., 2018), with participants making significant improvements in perceived motor competence.

Integrating Theory and Evidence

Motor development is an important, but under-appreciated aspect of child development, supporting developmental trajectories for health across the lifespan. The relationship between motor competence and physical activity is particularly significant since there seems to be a threshold of gross motor skills that are prerequisite for participation in the physical activities and physical play that are characteristic of childhood. Considering the well-established links between physical activity and well-being, both during childhood and later life, delays in motor development carry concerning implications. As was discussed early in this report, inactivity is associated with a host of non-communicable diseases, reduced life expectancy, and diminished quality of life.

"Very little is known regarding the gross motor development for individuals with visual impairments" (Brian, 2020, p. 12). The evidence base informing interventions to increase the motor competence of children with VI is especially weak. Nevertheless, almost all studies report that children with VI have significantly lower motor skills than their sighted peers. They also tend to have lower levels of perceived motor competence, which become lower as they get older, which further interferes with the development of motor competence. These findings are causes for great concern, as they suggest that children with VI are at greater risk of many diseases due to the greater likelihood in sedentary lifestyles than children without VI and that the relative difference between the two groups will increase as they get older.

More research is needed in this area to fully understand the different relationships among motor competence, perceived motor competence, affective aspects of movement, and effective intervention. However, the theoretical and empirical research reviewed in this report offers at least a foundation for evidence-informed practices.

If the empirically supported elements of these models are merged, certain key factors emerge as particularly significant concerning relationships between motor development, physical activity, and children's well-being: Motor Competence and Perceived Motor Competence (which, as has been seen, are tightly connected); Positive Affect (such as enjoyment); Pedagogy (and more generally focused teaching and/or support for skill learning); and Physical Activity (Loprinzi, Davis, & Fu, 2015). This pattern of relationships (see Figure 11).

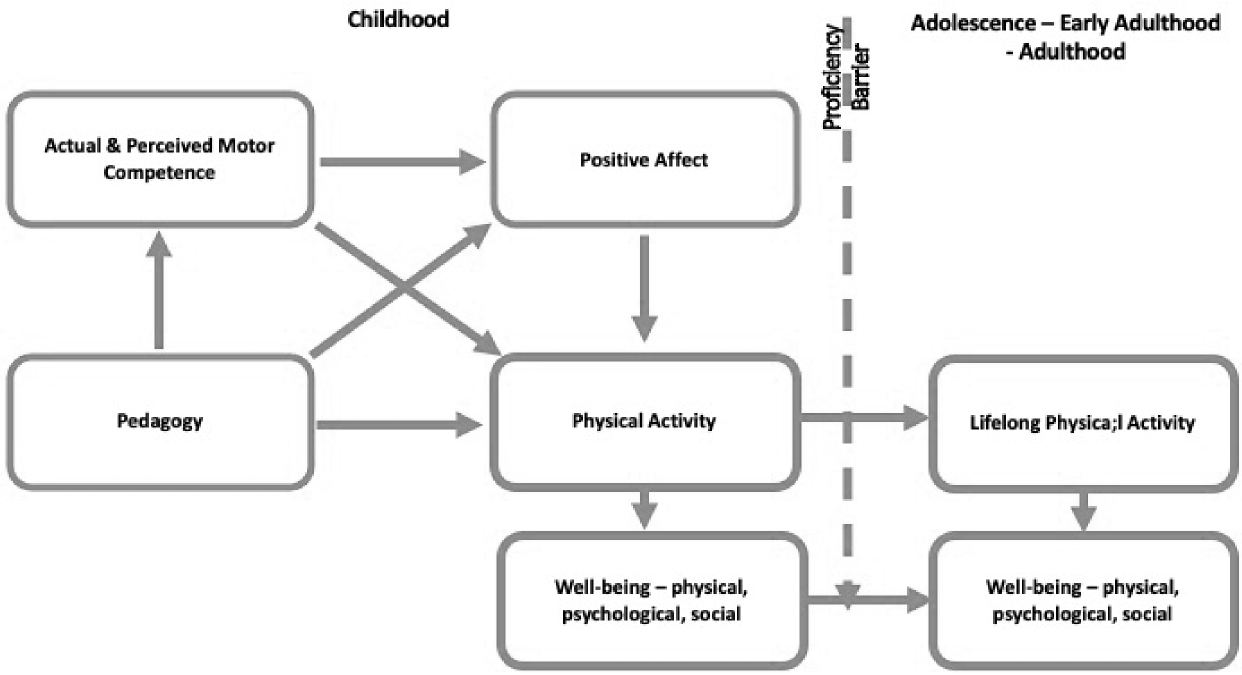


Figure 11: *Summary of model-based approaches to motor development*

Perceived and actual motor competence are known to be key variables in the adoption of active lifestyles (Huhtiniemi et al., 2019), and are both predictive of activity behaviour (Babic et al., 2014). The role of motor skill development as an underlying and supporting mechanism for physical activity behaviours is well-documented (De Meester et al., 2018; Robinson et al., 2015). Perceived motor competence may be a more powerful predictor of physical activity than actual motor competence (Brain, 2020). The two concepts are bracketed together here as their development seems to follow reciprocal pathways in which one of highly influenced by the other, and are rarely mutually exclusive (Stodden et al., 2008), so an individual's engagement with movement activities will be influenced by whether or not she thinks she is capable of doing them, and this judgement will be affected by whether or not she actually can do them. In addition, perceived and actual motor skill competence indirectly influence physical activity through increased enjoyment of physical activities (Loprinzi, Davis, & Fu, 2015).

Most of the research on the perceived and actual competence of children with VI is descriptive and cross-sectional, and, therefore, has been unable to give insight into changes across time (Getchell, Schott & Brian, 2020). In fact, Brian (2020) commented that "little to no research regarding youth with visual impairments is actually considered developmental" (p. 7), which represents a serious limitation of the current research base. Nevertheless, it seems clear that children with VI tend to demonstrate lower levels of motor competence than their sighted peers (Houwen et al., 2009; Haegele, Brian, & Goodway, 2015), and this is relatively consistent across each of Gallahue's domains of motor development (Goodway, Gallahue, & Ozmun, 2020): locomotor skills (Brian et al., 2020); manipulation skills (Houwen et al., 2008); and stability skills (Rutkowska et al., 2015). Children with VI experience delays in learning motor skills, and may never achieve comparable levels of motor competence as those without VI (Brian et al., 2018). This creates a significant barrier in the establishment in physical activity behaviours and the adoption of active lifestyles in later life. Considering the importance of fundamental movement skills in terms of both later motor competence and participation in physical activities. These findings strongly suggest that focusing on the support of children with VI's motor competence during the early years is vitally important in the establishment of healthy, active lifestyles.

'Pedagogy' is used here as an umbrella term for support and instruction in sport and physical activity and includes school physical education, coaching in sports clubs, and similar settings. Evidence suggests that such experiences can affect physical activity both directly and indirectly (Loprinzi, Davis, & Fu, 2015). They directly influence children's physical activity through engagement with moderate-to-vigorous movement activities. Despite concerns that many sessions are poorly taught and contribute relatively limited amounts of appropriately intense activity, well-planned and taught lessons can be effective settings. For example, meta-analyses of non-intervention studies by Hollis of primary (Hollis et al., 2017) and secondary school (Hollis et al., 2016) settings reported that, overall, students spent a mean 44.8% and 40.5% of PE in MVPA, respectively. Effective pedagogy can indirectly influence physical activity through increased positive affect, such as enjoyment (Visek et al., 2015). In turn, increased enjoyment and actual physical activity participation during childhood may influence physical activity during later years (Howie, Daniels & Guagliano, 2020).

There has been very little research explicitly addressing appropriate pedagogy for CYP-VI. Haegele's (2020) recent edited collection of chapters on 'Movement and Impairment' did not mention any studies on the subject, and other reviews give little direction, either (Brian et al., 2020; Houwen et al., 2009). The absence of focused research into the pedagogy of physical activity for children with VI might explain its omission from frameworks of the key variables associated with their participation in sport and physical activity (e.g., Houwen et al., 2009), but that stands in contradiction to evidence from general physical activity promotion. It is becoming increasing clear that mere participation is an insufficient basis for sustainable and enjoyable physical activity, and "it is best not to take the relationship as a "given"; it can be difficult to achieve; and can only be realised in association with a series of conducive 'change mechanisms'" (Whitelaw et al., 2010: 65). Pedagogy, including the ways in which physical activity experiences are presented, managed, and valued, is one of the most significant change mechanisms. Effective programmes for children with VI, therefore, require intentionality in their design so that they are deliberately structured and implemented to achieve the desired outcomes.

Positive affect, in this report, refers to the experience of positive emotions in the context of physical activity. It is plausible that enjoyment of movement activities will increase the intention to participate in these activities in the future, and this claim is consistent with key approaches to human behaviour, such as Bandura's Self-Efficacy Theory and the Theory of Planned Behaviour (Martin & Kulinna, 2004). Yet, there is surprisingly little research on the extent to which enjoyable childhood physical activity experiences influence the likelihood of being active later in life, despite its intuitive appeal. It is known that enjoyment and positive attitude towards physical activity are associated with activity during childhood (Dishman et al., 2005; Yli-Piipari et al., 2009). There is also some evidence, albeit limited, suggesting that developing children's fundamental motor skills can positively influence their levels of physical activity by enhancing their positive affect and perceived motor competence (Fu et al., 2013). So, positive seems to be an important, if under-researched, element of the complex relationships behind children's physical activity.

Children with VI enjoy physical activity opportunities when they are appropriately presented to them (Gür et al., 2020), and enjoyment and motivation are as frequently mentioned by children with VI as facilitators of engagement in physical activity as for their sighted peers (Jaarsma et al., 2014). Conversely, negative affect associated with early physical activity experiences (such as during physical education lessons) become barriers to participation (Yessick & Haegele, 2019). Overall, the limited evidence suggests that it is ineffectual and inappropriate pedagogy, rather than physical activity, *per se*, that interferes with the engagement of children with VI in these activities.

Regular physical activity provides a wide range of physical, psychological, and social benefits to children and young people. Inactivity and sedentariness significantly increase the risk of life-shortening diseases. The World Health Organisation, and almost every country in the world, has recommended the daily accumulation of at least 60 minutes of moderate-to-vigorous physical activity. Many children do not reach this goal, and children with disabilities are particularly unlikely to reach this standard and, therefore, to suffer the consequences to their well-being, both during childhood and in later life. Studies reported earlier show that children with VI typically engage in less than 30 minutes of moderate-to-vigorous physical activity per day, and this is even lower among those with very low vision and blindness. As a consequence of this, children with VI tend to have delayed motor development, which, in turn, limits their capability to participate.

Three variables seem to be particularly important in understanding and supporting the physical activity of children and young people with VI: perceived and actual motor competence; positive affect, such as the enjoyment of activity experiences; and pedagogy, including structured, intentional strategies to support their specific needs. Whilst each of these factors are influential, evidence presented in this report suggests that the development of motor competence is fundamental, as it provided the necessary skills for engagement with any form of activity.

Methodology

This project, due to its scope and breadth, incorporated a multiple method approach. This meant that the project team utilised a range of quantitative and qualitative data collection tools to try to best understand the complex and dynamic relationship between motor competence, physical activity engagement, and general wellbeing. All the sample targets outlined in the Tender were surpassed. The objectives of the project were translated into methods as outlined in the table below.

Table 10: *Translating project objectives into research methods*

Objective	Method
To identify and demonstrate the gaps in physical development and motor competence in children with visual impairment.	Desk-based research Motor competence testing CYP-VI questionnaire Parent/carer questionnaire
To understand the sport, physical activity, and active play choices and habits of children with visual impairment.	Desk-based research CYP-VI Questionnaire Family-based interviews Industry professional interviews
To consider how participation in sport and physical activity affects the mental and social wellbeing of CYP-VI.	Desk-based research CYP-VI questionnaire Family-based interviews Industry professional interviews

Participants

The breadth of the objectives and scope of this project required the engagement of a range of participant groups, including CYP-VI; parents/carers and immediate family of CYP-VI; industry professionals with responsibility for CYP-VI services in their organisation. As such, a purposive sampling approach was adopted (Patton, 2002) as this would ensure participants were able to offer the depth and quality of information required. Furthermore, it has been suggested to be most appropriate sampling strategy for hard-to-reach or specialised populations (Maxwell, 1997) and enabled the research team to exercise their judgement in deciding who would provide the best perspectives on the issues related to CYP-VI and participation in sport and physical activity. Due to the range of methods adopted the research team were also conscious of not wanting to over burden any individual, especially CYP-VI whose involvement was critical to several data collection methods.

The research team identified individuals from their own networks to initiate participant recruitment and data collection. However, to achieve the most nationally representative sample, it was important to utilise additional national networks to support participant recruitment. BBS were crucial to linking the research team to a variety of organisations, including VI charities, sports organisations, local authorities, and schools. After initial introductions, the research team were responsible for all ongoing communication with organisations and individuals. Support was sought from these organisations to distribute online questionnaire to potential participants.

Due to the number of data collection methods CYP-VI and their parents/carers could potentially participate in, it was determined that a simple online form, created using Microsoft Forms, that allowed potential participants, to select the data collection methods that they would be willing to participate in (i.e., questionnaire, interview, and motor competence testing). This approach was primarily adopted to recruit CYP-VI participants for motor competence testing and parents/carers for family-based interviews as ongoing communication to organise undertaking data collection for these methods was required. This proved to be an effective approach and allowed the research team to communicate with potential participants using their preferred method.

The desired sample sizes and those recruited for the project are presented below in Table 11. The research team have, in all but one sample, exceeded the proposed sample sizes from BBS.

Table 11: Desired and actual number of participants recruited

Data collection method	Sample population	Desired no. participants	Actual no. participants
Motor competence testing	CYPP-VI	15	22
CYP-VI Questionnaire	CYP-VI	45	61
Parent/Carer Questionnaire	Parents/carers	15	28
Family-based interviews	CYP-VI Parents/carers Other immediate family	5	5
Industry professional interviews	Industry professionals	5	6

Data collection and analysis

Data collection incorporated three methods: 1) motor competency testing; 2) questionnaires; and interviews with three stakeholder groups. The methods were chosen to best answer the research objectives outlined above and to do so in a way that caused minimal inconvenience to study participants. The aims, objectives, and methods of this project are summarised below. From these, several work strands were identified that became the main foci of the research activity:

- Rapid evidence synthesis;
- Motor competence testing;
- Family-based interviews;
- Industry professional interviews;
- CYP-VI questionnaire;
- Parent/carer questionnaire.

Rapid evidence synthesis

The first task was to review the existing literature about motor competence and physical activity participation amongst CYP-VI. An extended, systematic scoping review of the literature pertaining to the relationships between motor competence, engagement in physical activity and subsequent effects on psycho-social well-being of CYP-VI. Evidence for this literature review were collected using a 'rapid review' method. This is "a streamlined approach to synthesising evidence in a timely manner" (Khangura, Konnyu, Cushman, et al, 2012: 1). It will follow many of the strategies used by more established approaches, adapted for a faster and more variegated response. Systematic reviewing, generally accepted as the 'gold standard' of methods of summarising and analysing research findings (Munn et al., 2018), requires a considerable amount of time and investment in human resourcing, and narrowly focuses on a specific question, whereas rapid reviewing allows quicker results and a more diverse coverage of subject-matter. For these reasons, the faster, more flexible approach is often used by policymakers, decision makers, stakeholders and other knowledge users. By adopting a rapid reviewing methodology, the hope is to realise some of the virtues of systematic reviewing, without becoming overcome by its inherent restrictions.

Searches were undertaken using several specialist academic databases (PsycARTICLES, PsycINFO, SPORTdiscus, CINAHL Complete), Google Scholar, and the academic social networking sites, ResearchGate, and Academia.edu. The following criteria will be used to keep searches focused:

- Published from 1 January 2010 to 30 November 2020;
- Study conducted in either primary / elementary or secondary / high schools;
- Study either investigated relationships between motor competence and physical activity, or physical activity and psychological/social well-being, for both visually impaired and non-visually impaired school aged children;
- Empirical study, systematic review, or conceptual discussion.

The searches adopted a set of broad MeSH terms (Medical Subject Headings) to capture the most recent studies and reviews. For example, "visual" AND "motor" AND “children”. Data on each context of interest were extracted, and the findings validated with reference to other gathered data, and published reviews.

We have presented the rapid evidence synthesis in the literature review section of this document. This review is one of the most comprehensive reviews of the literature that explores CYP-VI participation in sport and physical activity whilst considering the impact upon psycho-social wellbeing.

Motor competence testing

Tests of motor competence in CYP-VI are a relatively new phenomena and have received very little attention in the sport and physical activity literature. There have, until recently, been no studies that have sought to understand the potential links between motor competence and engagement in sport and physical activity. This dearth of literature presented an initial hurdle in determining the most appropriate motor competence test to use. The research team undertook an in-depth review of the motor competence tools that are available, their appropriateness for using with CYP-VI, the ability to utilise them in school and leisure centre environments, and the time required for administration of the test.

Following this review, two motor competence tests were considered for use for the project: 1) the Bruiniks-Oseretsky Test of Motor Proficiency second edition (BOT-2); and 2) the Test of Gross Motor Development third edition (TGMD-3). Both tests were piloted at a non-maintained school for sensory impaired and other needs children and young people. A total of six participants completed the motor competence tests (BOT-2, n=3; TGMD-3, n=3). Data collected as part of the pilot testing were not included in the final analyses. Pilot testing suggested that the TGMD-3, would be suitable for the needs of this project. Furthermore, during the pilot testing period, there were several critical research publications (Brian et al., 2019; Brian et al., 2020a; Brian et al., 2020b) were published that further positioned TGMD-3 as the most appropriate motor competence test to adopt for this project.

Data were collected from three groups: 1) partially sighted; 2) severely sight impaired; and 3) non-sight impaired. The third group were incorporated for comparative purposes.

Test of Gross Motor Development (3rd Edition)

The TGMD-3 entered its third iteration in 2019. It operated two sub-tests; 1) Locomotor; and 2) Ball Skills. The locomotor subtest measures the gross motor skills that require fluid, coordinated movement of the body as a child moves in from one direction to another. The ball skills subtest measures the gross motor skills that demonstrate efficient throwing, striking, and catching movements. The test provides an overall composite score; scaling and combining the two subtests to form the Gross Motor composite. The locomotor subtest comprises the following skill tests: 1) running; 2) galloping; 3) Hopping; 4) skipping; 5) horizontal jumping; and 6) sliding. The ball skills subtest is comprised of seven skill tests: 1) two-handed strike; 2) one-handed strike; 3) one handed dribble; 4) catching; 5) kicking; 6) overhanded throw; and 7) underhanded throw.

Questionnaires

It was necessary to develop two distinct but complementary questionnaires; one for CYP-VI and one for parents/carers of CYP-VI. We were conscious of ensuring that the questionnaire balanced questions that could answer the aims of the project whilst providing quality control (validity and reliability) in the measures included.

The CYP-VI questionnaire was developed using bespoke demographic questions tailored to capture factors including date of birth, post code, severity of condition, and gender. The remainder of the questionnaire was comprised of three validated measures: 1) the Children's Physical Activity Questionnaire (C-PAQ, Corder et al., 2009); 2) the Test of Perceived Motor Competence for Children with Visual Impairment (TPMC, Brian et al., 2017); and the Stirling Children's Wellbeing Scale (Liddle & Carter, 2015).

The C-PAQ provides 49 activities for respondents to identify their involvement in over the last seven days. The measure can measure group-level moderate-to-vigorous physical activity (MVPA) at the lower MVPA threshold and group-level physical activity energy expenditure (PAEE) (Freedson, Melanson & Sirard, 1998).

To understand children's perceived motor competence, the TPMC (Brian et al., 2017) was included in the questionnaire. This measure was developed for children aged 3-7 years old and prior to its development there were no assessments of perceived motor competence available for CYP-VI. The TPMC asks participants to compare themselves to peers and decide which one is "like them" or which is "really true" for them, with the scale demonstrates strong psychometric properties (Brian et al., 2017; Brian et al., 2020).

The Stirling Children's Wellbeing Scale was developed from a positive psychological perspective, focussing on positive aspects of wellbeing rather than being deficit-based mental health model (Liddle & Carter, 2015). As a valid measure of emotional and personal wellbeing, including three items that form a social desirability sub-scale. It is considered appropriate for use with school-aged populations and offers a concise and robust measure of wellbeing. Figure 12, shows the geographical spread of questionnaire participants. Postcode data were used to map CYP-VI participants' home locations.

Figure 12: *Geographical spread of CYP-VI questionnaire respondents*

The parent/carer questionnaire was developed using the same demographic questions as in the CYP-VI questionnaire. The remainder of this questionnaire, however, comprised one validated measure, the International Physical Activity Questionnaire long-form (IPAQ; Hagströmer, Oja & Sjöström, 2006), and adopted the activity questions from the C-PAQ to determine parental involvement in similar activities to their children. Though this is not a valid measure for adults it is a helpful indicator of activity engagement that can be easily compared to responses from CYP-VI.

All questionnaire data were entered into an online platform (onlinesurveys.ac.uk) and data were exported into a Microsoft Excel spreadsheet and cleaned, removing blank responses, duplicates, and ensuring all formatting were correct. Next data were imported into SPSS Statistics version 27 for analysis. A range of descriptive and inferential statistical tests were adopted to explore and present data.

In both children and adults, differences in physical activity were compared between males and females, age groups (children only) and sight impairment groups using one-way between subject's ANOVA. Similarly, in-children differences in both sub-components of wellbeing were also compared using one-way between subject's ANOVA. In the event of a significant main effect, post-hoc pairwise comparisons were undertaken. Furthermore, in children linear regression analyses were used to determine whether physical activity predicted both sub-components of wellbeing and to determine whether the Index of Multiple Deprivation (IMD) predicted physical activity and also both indices of wellbeing. Finally, in children to determine whether physical activity predicted each aspect of motor competency multinomial logistic regression analyses were adopted. statistical significance was accepted at the $p<0.05$ level. For comparative analyses using ANOVA effect sizes were calculated using partial eta squared (pn^2).

Interviews

Interviews were conducted with two groups: 1) CYP-VI and their families; and 2) industry professionals responsible for CYP within their organisation. These two groups were important to understand the role and importance of family in the participation of CYP-VI in sport and physical activity from two distinct perspectives. Both groups also offered unique insight into the development of motor competence, opportunities available to support CYP-VI, their opinions on where gaps exist within current provision, and what changes could be made to enhance current sport and physical activity opportunities and delivery. Both interview processes had areas of procedural commonality, including the interview schedule development, their remote/virtual data collection, and their analytical procedures.

Interview schedules were developed deductively, drawing on the existing literature. These were discussed extensively between members of the research team and agreed upon. Following the first interviews the schedules were subject to minor revisions that focussed on question order and flow.

When potential participants were identified, they were sent participation information sheets and consent forms in their preferred format, and time was given for full consideration of the information provided and for any questions or points of clarification to be raised about the project as a whole, or the interview process. When participants indicated their willingness to participate, interviews were arranged for a date and time most convenient for the participant.

Data were collected via face-to-face online interviews utilising reliable and stable digital platforms (i.e., Zoom/Microsoft Teams); the choice of which platform was determined by the participant. The potential of video conferencing as a research tool has been suggested to be "unlimited" (Sullivan, 2012: 9); and recent advances in the quality, reliability, ease of use, cost effectiveness, and security options (Archibald et al., 2019) means these platforms now provide an excellent tool, particularly where travel is not permissible.

All interviews were audio recorded and audio was transcribed verbatim for analysis. All interview data were analysed thematically, following the six-step procedure outlined by Braun and Clarke (2006). Firstly, the research team familiarised themselves with the data. This included reviewing transcripts alongside the audio recordings to ensure quality of transcription and resolve any inaudible or unclear elements of the transcripts and allowed for initial thoughts and ideas about the data to be identified. Second, four researchers (two for family interviews and two for industry interviews), independently of each other, generated their initial codes across the data sets. Next data were considered for patterns and codes to be collated into potential themes before being reviewed for 'sense-making', ensuring that potential themes worked in relation to the codes and across the entire data set. Fifth, themes were defined and named through an ongoing process of refinement and in consideration of the narrative being developed across the data set in its entirety. Finally, data themes were considered, and coded compelling data extracts were selected that best illustrated the specific theme and related back to the overarching research question.

Family-based interviews

Once contact with a parent/carer of a CYP-VI had been established (mother, n=4; father, n=1), Most family-based interviews were conducted during early evening or at weekends. Interviews were conducted in a semi-structured, relaxed, and conversational manner that provided necessary flexibility to ask additional questions based on the stories and situations of the CYP-VI and their families. The main issues discussed included:

- background to family;
- education and VI;
- impact of VI on everyday life;
- impact of VI on physical skills and abilities;
- physical activity and sport in the family.

The five families included seven CYP-VI, three siblings without VI, five mothers (one with VI) and five fathers (one with VI); of these 20 family members, 15 participated in the interviews, five CYP-VI, two siblings without VI, five mothers and three fathers. Two CYP-VI did not participate in the interviews at their parents' request: one child (10 years old) did not participate at her mother's request as she also has autism spectrum disorder; the second child (7 years old) was present in the background, while her elder siblings did participate in the interview.

The CYP-VI who participated in interviews were aged between 4 and 17 years old (M=8.6 years old; ± 5.2 years) and ranged from severely sight impaired to sight impaired. The extent to which the CYP-VI contributed to conversations varied with some well-engaged and others less so. Interviews lasted between 50 minutes and 46 seconds, and 72 minutes and 12 seconds (M=60 minutes 57 seconds; ± 10 minutes 27 seconds).

Industry professional interviews

Interviews with industry professionals were a key consideration for this project due to their role as key facilitators and points of contact for a range of services for CYP-VI and their families. Several of the participants (n=3) were suggested as possible participants by BBS and an additional three CYP professionals were recruited by the research team. All interviews were conducted during 'business hours'. Interviews began with the researcher re-confirming the participants' willingness to participate and checking for understanding and asking whether there were any clarification questions. Once this had been completed the interviews were conducted in a relaxed, conversational manner following the semi-structured interview schedule. The main issues discussed were:

- Participation in sport and physical activity amongst CYP-VI;
- The role of family in engaging CYP-VI in sport and physical activity;
- Psycho-social factors related to participation in sport and physical activity;
- Motor skill development amongst CYP-VI.

Interviews lasted between 49 minutes and 7 seconds, and 78 minutes and 3 seconds (M=62 minutes 43 seconds; ± 11 minutes 3 seconds).

Results and findings

This multiple method project sought to try and best understand the complexities associated with engagement in sport and physical activities amongst CYP-VI and the relationship with social and mental wellbeing.

CYP-VI participants

A total of 61 CYP-VI participated in the questionnaire component of this study (see Table 12). There were more male (n=33) participants than female (n=28). CYP-VI ages ranged from five to seven years old (M=6.13, ±0.9 years).

Table 12: *CYP-VI participant characteristics*

	Boys N (%)	Girls N (%)	Overall N (%)
Age			
5 years old	10 (16.4)	10 (16.4)	20 (32.8)
6 years old	13 (21.3)	4 (6.6)	17 (27.9)
7 years old	10 (16.4)	14 (23.0)	24 (39.3)
Level of impairment			
Slightly sight impaired	20 (32.8)	14 (23.0)	34 (55.7)
Severely sight impaired	13 (21.3)	14 (23.0)	27 (44.3)
Nature of condition			
Acquired	12 (19.7)	5 (8.2)	17 (27.9)
Congenital	21 (34.4)	23 (37.7)	44 (72.1)
Additional Health condition(s)			
Autism spectrum disorder	5 (8.2)	2 (3.3)	7 (11.5)
Attention deficit hypertension disorder	4 (6.6)	1 (1.6)	5 (8.2)
Diabetes mellitus	1 (1.6)	2 (3.3)	3 (4.9)
Asthma	1 (1.6)	0	1 (1.6)

The majority (95.1%) of participants had a certificate of visual impairment and a small percentage (4.9%) were unsure. There were more sight impaired (55.7%) than severely sight impaired (44.3%) participants; with almost three-quarters of participants (73.3%) having a congenital condition and other participants (27.9%) reporting that their condition was acquired. Most participants (52.5%) reported that they had no additional health-related impairments or needs, though 31.1% reported having additional health-related impairments or needs, and a small number (16.4%) reported being unsure whether they had any additional health-related impairments or needs. Of those participants that reported additional health-related impairments or needs, autism spectrum disorder (ASD) was most reported (36.8%), followed by attention deficit hyperactivity disorder (ADHD) (26.3%), then diabetes mellitus (15.8%) and Asperger's syndrome (15.8%) whilst a single participant indicated an additional health-related impairment not listed (5.8%), that was reported to be asthma.

Questionnaires

There were lots of similarities between the CYP-VI and parent/carer questionnaires. These data are presented independently in the first instance, but where possible and appropriate, data are analysed and presented together.

Children and young people's questionnaire

Participants were asked about their sport and physical activity engagement using questions from the C-PAQ (Corder et al., 2009). CYP-VI reported participating in 23 of the 49 activities (46.9%): are categorised as: 1) sports activities; 2) leisure activities; 3) Activities at school; and 4) other activities (including sedentary). Of those 23 activities, eight were sport activities, five were leisure activities, one was an activity at school, and nine were 'other' (often sedentary) activities. A full breakdown of these activities, the number of CYP-VI participants, the total number of times that activity was participated in, and the total number of participatory minutes is presented below (see Table 13).

Table 13: *CYP-VI activity participants, number of times participated, and total number of participation minutes*

Activity	Number of CYP-VI participants	Total no. times participated (last 7 days)	Total no. minutes participation
SPORTS ACTIVITIES			
Aerobics	4	5	285
Dancing	1	1	120
Football	2	4	210
Gymnastics	4	5	390
Martial Arts	3	3	170
Netball	2	3	150
Running/Jogging	3	5	150
Swimming	5	6	225
Total	***24***	***32***	***1700***
LEISURE ACTIVITIES			
Playing in a playhouse*	1	2	180
Playing on playground	18	32	780
Playing with pet(s) *	7	33	1,020
Scooter	2	7	185
Walking the dog	8	40	1175
Walking for exercise	7	21	745
Total	***43***	***135***	***4,085***
ACTIVITIES AT SCHOOL			
Physical education	48	52	2,965
Total	***48***	***52***	***2,965***
OTHER ACTIVITIES (INCLUDING SEDENTARY)			
Arts and crafts*	6	10	600
Imaginary play*	3	8	480
Play indoors with toys*	40	224	20,850
Computer games*	9	31	2,610
Musical instrument*	4	15	1,140
Reading*	15	59	1,270
Travel to school by car/bus*	61	301	919
Using a computer/internet*	42	158	10,946
Watching TV*	61	373	36,360
Total	***241***	***1179***	***75,175***

* denotes a sedentary activity

Data showed that the number of times CYP-VI participated in sedentary activities (n=249) was higher than the number of times they participated in sport and physical activities (n=60). Subsequently, the total number of minutes spent in sedentary activities (76,355 minutes) was much higher than the total number of minutes spent in sport and physical activities (7,550 minutes). This data indicate that CYP-VI spent 91% of their week involved in sedentary activities and only 9% engaged in sport and physical activities.

CYP-VI Physical Activity Energy Expenditure (PAEE)

There were no gender differences in PAEE (F (1, 61) = 0.49, p>0.05, pn^2 = 0.01).

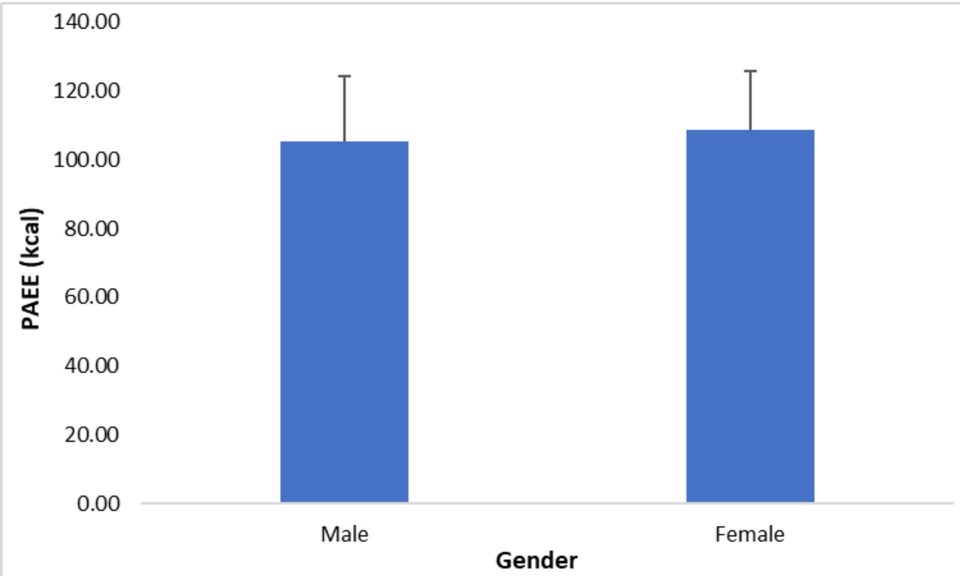


Figure 13: *Difference between sex and PAEE*

There were no differences in PAEE between year groups (F (1, 61) = 1.25, p >0.05, pn^2 = 0.06).

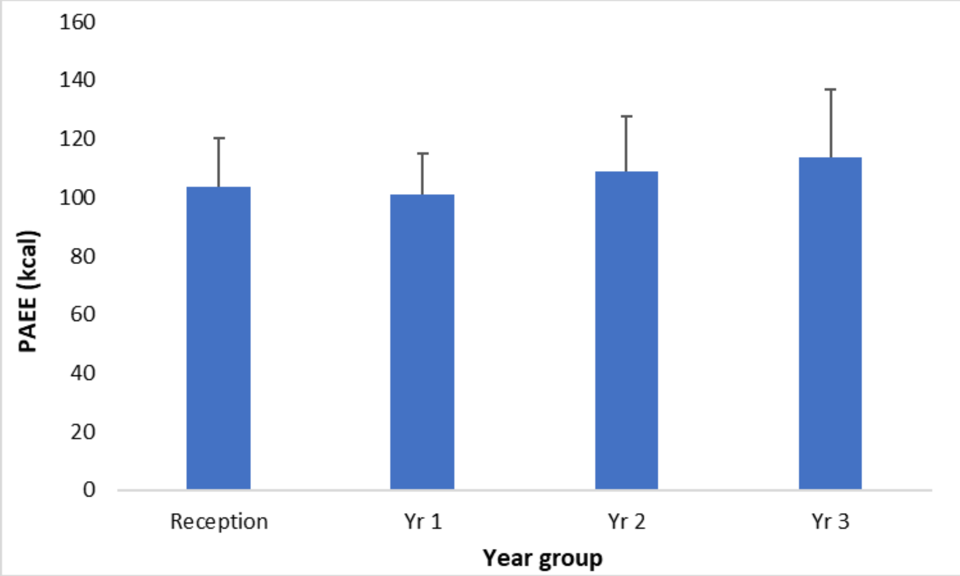


Figure 14: *Difference between school year groups and PAEE*

There were no differences in PAEE between impairment groups (F (1, 61) = 1.25, p >0.05, pn^2 = 0.06).

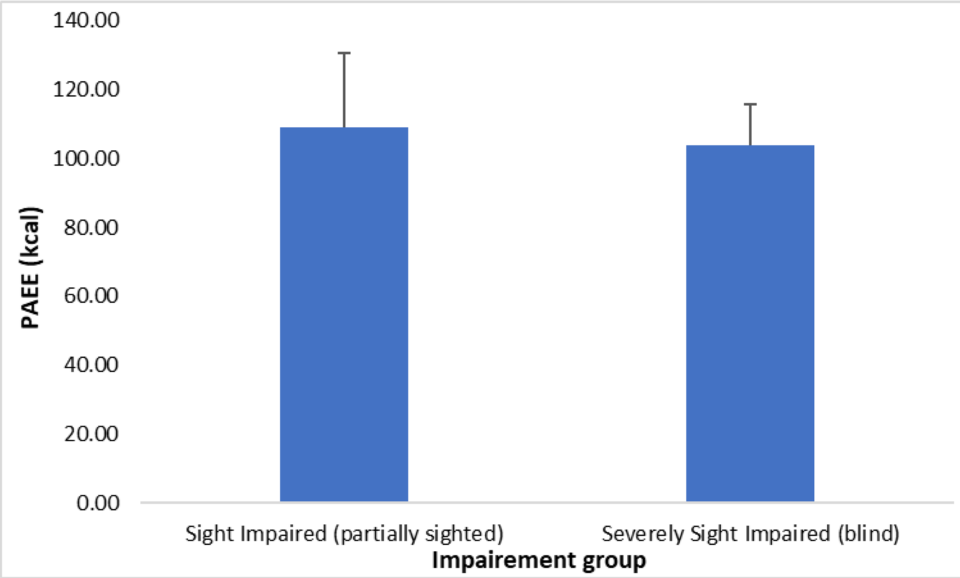


Figure 15: *Difference between level of VI and PAEE*

Psycho-social wellbeing

There were no gender differences in either the wellbeing (F (1, 61) = 0.41, p >0.05, pn^2 = 0.01) or social desirability (F (1, 61) = 0.01, p >0.05, pn^2 = 0.00) components of wellbeing.

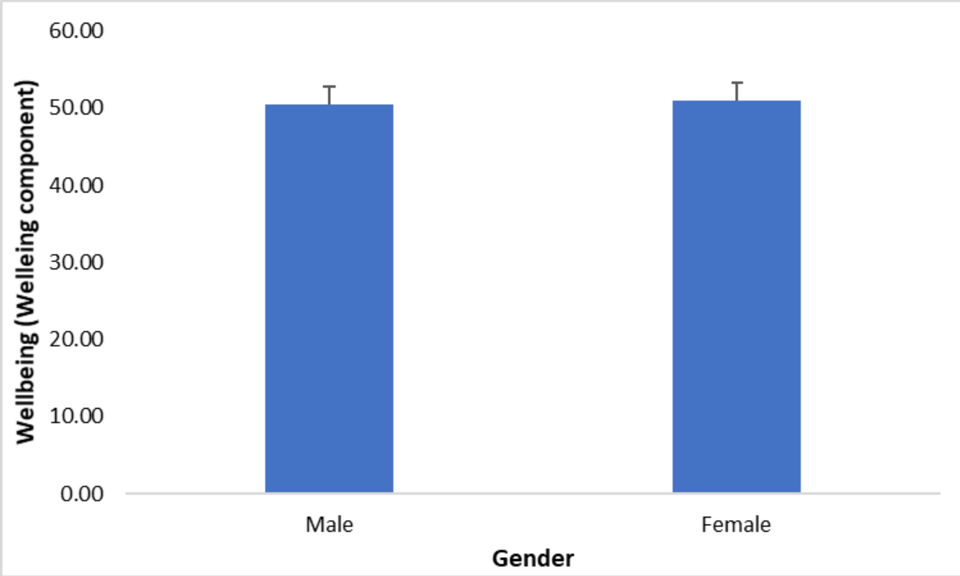


Figure 16: *Difference between sex and wellbeing*

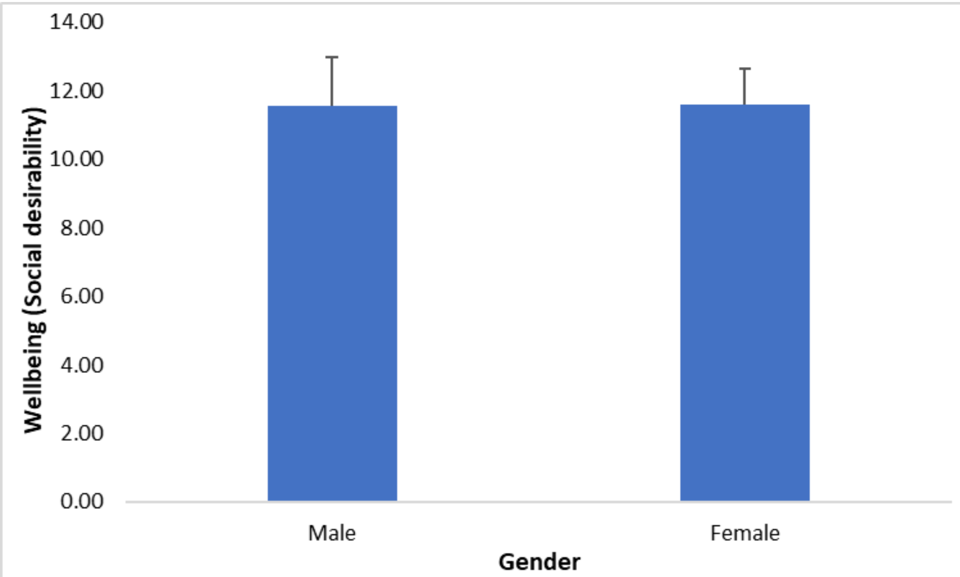


Figure 17: *Difference between sex and social desirability*

There were no differences between impairment groups for either the wellbeing (F (1, 61) = 0.03, p>0.05, pn^2 = 0.00) or social desirability (F (1, 61) = 1.60, p >0.05, pn^2 = 0.03) components of wellbeing.

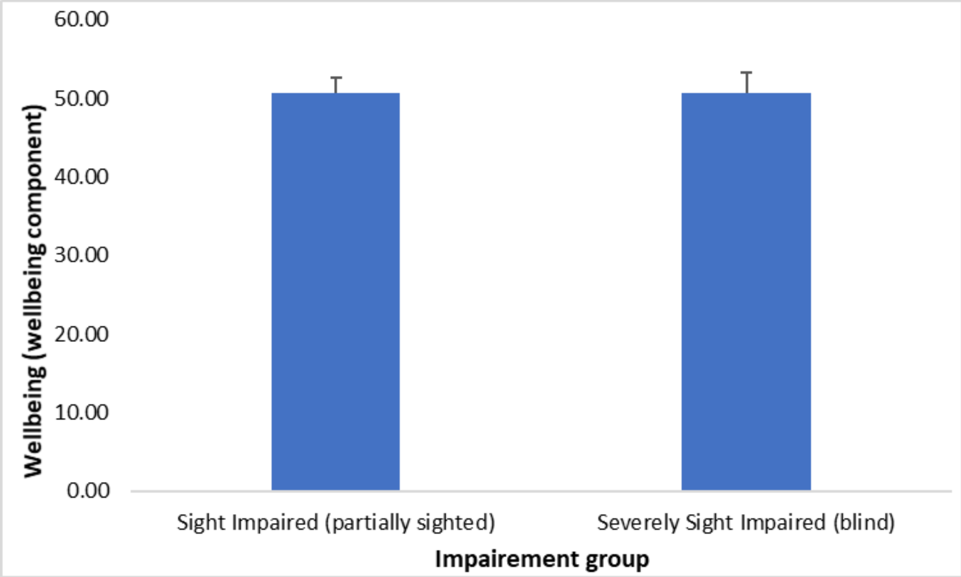


Figure 18: *Difference between level of VI and wellbeing*

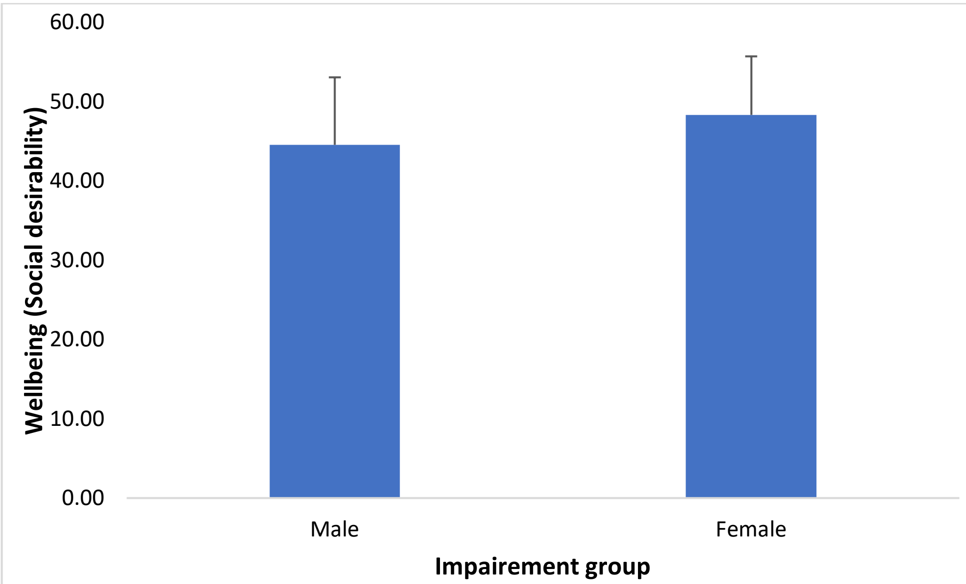


Figure 19: *Difference between level of impairment and social desirability*

There were no differences between year groups for either the wellbeing (F (1, 61) = 0.91, *p*>0.05, pn^2 = 0.05) or social desirability (F (1, 61) = 0.46, *p*>0.05, pn^2 = 0.02) components of wellbeing.

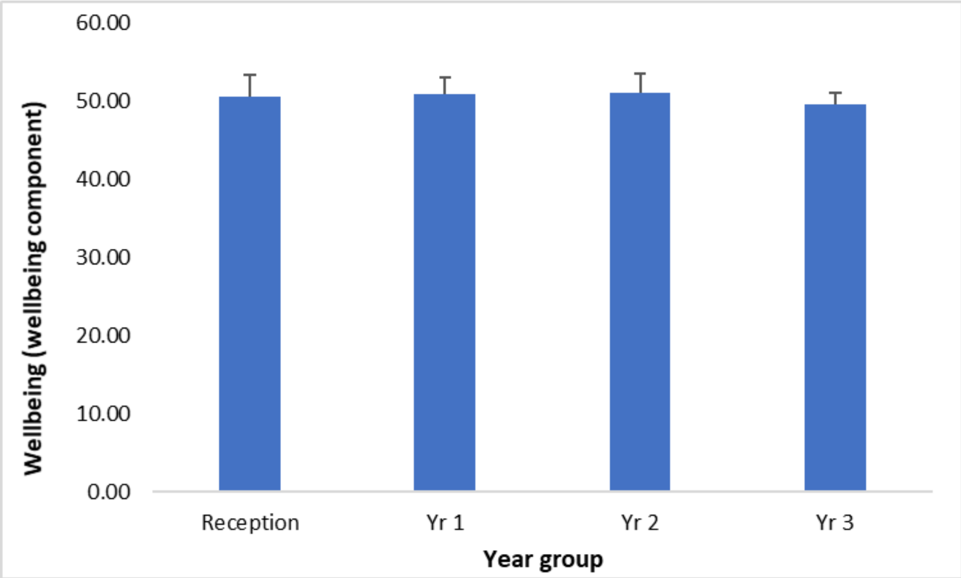


Figure 20: *Difference between school year group and wellbeing*

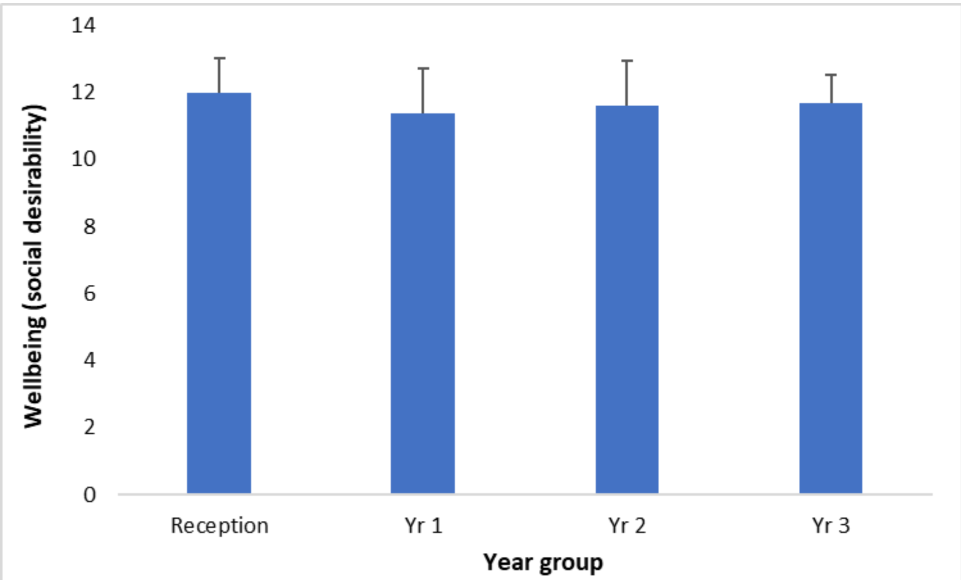


Figure 21: *: Difference between school year group and social desirability*

Significant predictors

- PAEE was found to be a significant predictor of both the wellbeing (R^2 = 0.08, p<0.05) and social desirability (R^2 = 0.07, p<0.05) sub-components of wellbeing.
- IMD was not found to be a significant predictor of either the wellbeing (R^2 = 0.00, p>0.05) or social desirability (R^2 = 0.01, p>0.05) sub-components of wellbeing.

- IMD was not found to be a significant predictor of PAEE ($R^2 = 0.00$, $p>0.05$).
- PAEE was not shown to be a significant predictor ($p>0.05$) of perceived motor competence.

Parent/carer questionnaire

A total of 28 parents/carers completed questionnaires for this study. There was a larger number of responses from females (n=20) than males (n=8). Parents ages ranged from 30-49 years old (M=38.78 years old; ± 5.71 years). Most parents (n=23) reported not having a certificate of visual impairment, though several did (n=5); those with a certificate of visual impairment reported being sight impaired (n=4) or severely sight impaired (n=1). Parents were asked questions to determine their level of physical activity over a seven-day period, and they were also asked to report their engagement in activities included in the C-PAQ.

Parents reported participating in 21 of 49 activities across the C-PAQ. Of those 21 activities, seven were sport activities, five were leisure activities, and nine were 'other (often sedentary) activities. A full breakdown of these activities, the number of parent/carer participants, the total number of times that activity was participated in, and the total number of participatory minuets is presented below (see Table 14).

Data demonstrated that the parents/carers of CYP-VI participated in one more sport and physical activities than sedentary (11 physical activities, 10 sedentary activities). The number of times parents/carers participated in sedentary activities (n=134) was higher than the number of times they participated in sport and physical activities (n=59). Accordingly, the total number of minutes spent in sedentary activities (46,170 minutes) was over three times more than the total number of minutes spent engaged in sport and physical activities (10,925 minutes). This means that parents/carers of CYP-VI spend 80.87% of their week engaged in sedentary activities and only 19.13% engaged in sport and physical activities.

Table 14: *Parent/carer activity participants, number of times participated, and total number of participation minutes*

Activity	Number of parent/carer participants	Total no. times participated (last 7 days)	Total no. minutes participation
SPORTS ACTIVITIES			
Aerobics	3	3	165
Dancing	2	2	180
Football	2	2	150
Hockey	1	5	120
Netball	1	1	45
Running/Jogging	3	9	420
Tennis/Racquet Sports	1	6	360
Total	***13***	***28***	***1440***
LEISURE ACTIVITIES			
Bike Riding	3	3	270
Household Chores	24	157	6,165
Playing with pet(s) *	3	30	1,260
Walking the dog	6	35	1,980
Walking for exercise	13	57	1,070
Total	***49***	***282***	***10,745***
OTHER ACTIVITIES (INCLUDING SEDENTARY)			
Listen to Music*	8	39	2,585
Computer Games*	5	22	1,680
Musical instrument*	2	11	660
Reading*	10	54	2,730
Sitting Talking*	15	55	2,175
Talking on the Phone*	23	321	3,475
Travel by Bus/Car*	13	110	3,060
Using Computer/Internet*	28	228	11,445
Watching TV*	27	239	17,100
Total	***131***	***1079***	***44,910***

* denotes a sedentary activity

Physical Activity Energy Expenditure was found to be a significant predictor of both the wellbeing ($R^2 = 0.08$, $p<0.05$) and social desirability ($R^2 = 0.07$, $p<0.05$) sub-components of psycho-social wellbeing in CYP-VI.

Parent/carer Physical Activity Energy Expenditure (PAEE)

There were no gender differences in PAEE ($F(1, 28) = 1.37$, $p>0.05$, $p\eta^2 = 0.05$).

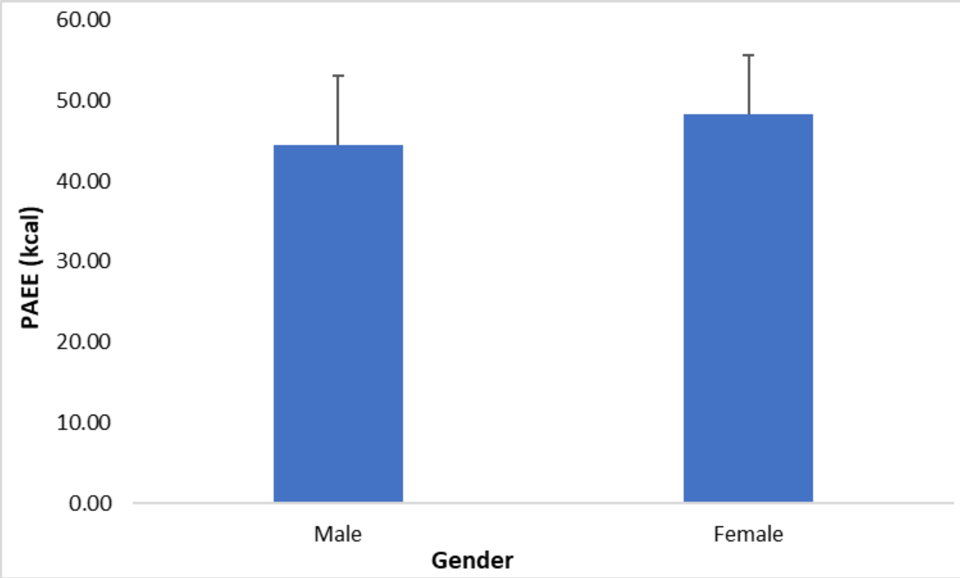
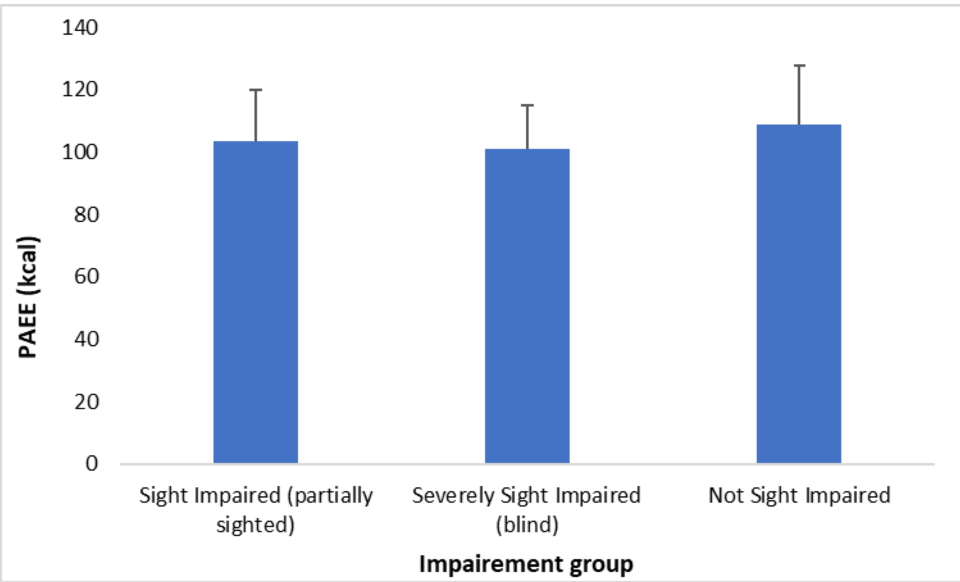


Figure 22: *Difference between parental sex and PAEE*

There was a significant main effect for PAEE ($F(1, 28) = 5.17$, $p<0.05$, $p\eta^2 = 0.29$) in impairment groups. Post-hoc pairwise comparisons showed that PAEE was significantly larger in the not sight impaired group in relation to the partially sighted group.



Socio-economic status was not found to be a significant predictor of PAEE (R^2 = 0.02, p>0.05).

Motor competence

Motor development was considered from two perspectives: 1) Perceptions of motor competence from CYP-VI; and 2) actual motor competence, tested through the TGMD-3. These two approaches were adopted as it was important to explore perceived motor competence and actual motor competence occurred and start to understand how and where it might be able to intervene to enhance CYP-VI motor competencies and, ultimately, engagement in physical activities.

Perceived motor competence

All survey participants Children with visual impairments completed the Test of Perceived Motor Competence for Children with Visual Impairment (TPMC-VI; Brian et al., 2017). Data showed that there were pronounced differences between the mean scores of CYP-VI and non-sight impaired groups.

Table 15: *CYP-VI and non-sight impaired CYP perceived motor competence*

TPMC-VI Vignette	**Partially sight impaired M (±)**	**Severely sight impaired M (±)**	**Non-sight impaired M (±)**
Swinging on swing set	2.08 (.88)	2.00 (.92)	3.86 (.69)
Climbing on monkey bars	1.59 (.72)	1.44 (.64)	3.71 (.49)
Tying shoelaces	1.56 (.76)	1.63 (.74)	3.71 (.76)
Skipping	1.90 (.75)	1.96 (.76)	3.57 (.79)
Running race	2.62 (1.02)	2.70 (.87)	3.86 (.69)
Hopping	1.56 (.65)	1.48 (.58)	3.71 (.76)
TPMC-VI Score	1.89 (0.31)	1.87 (.29)	3.74 (.40)

There were also small differences between the mean scores of partially sight impaired and severely sight impaired groups; with the partially sighted participants reporting greater perceived motor competence in three activities (e.g., swinging on a swing set; climbing monkey bars, and hopping). However, the severely sigh impaired group also reported perceptions of greater motor competence in three activities (e.g., tying shoelaces; skipping; and running).

Actual motor competence

A total of 24 CVPVI indicated that they would be willing to participate in a motor competence test. From this number, we purposively sampled individuals based on their age, their VI status (i.e., partially, or severely sight impaired). All 24 CYP-VI were contacted, and efforts were made to coordinate dates and times for tests to be conducted. During the process of organising tests, six individuals withdrew, and it was not possible to organise and facilitate tests for three potential participants. We also recruited a sub-group of non-visually impaired children and young people for comparative purposes and to explore the differences in motor competence exhibited between the groups.

The partially sighted sub-group (n=8) comprised males (n=5) and females (n=3) aged between 6.4 and 9.0 years old (M=7.6; ± 0.93). The severely sight impaired group (n=7) comprised males (n=3) and females (n=4) aged between 6.0 and 8.0 years old (M=6.9; ±0.62). Finally, the non-sight impaired sub-group comprised males (n=4) and females (n=3) aged between 6.1 and 7.7 years old (M=7.0; ±0.62).

Motor competence scores (Table 16) show the means and standard deviations between each of the three groups. Data show that severely sight impaired individuals scored lower on every locomotor and ball skill test than their partially sighted and non-sight impaired peers. Overall, Gross Motor Index mean scores between both severely and partially sighted VI groups were lower than the non-sight impaired group.

Table 16: Sub-group scores for TGMD-3

	Severely Sight Impaired Mean (±)	Partially Sight Impaired Mean (±)	Non-sight Impaired Mean (±)
Locomotor Skills Subset Scores			
Run	2.29 (0.49)	3.12 (0.35)	6.57 (0.98)
Gallop	1.71 (0.76)	3.00 (0.53)	6.14 (0.90)
Hop	2.00 (1.29)	3.00 (1.07)	6.14 (0.90)
Skip	1.71 (0.76)	2.25 (0.71)	5.29 (0.76)
Horizontal Jump	1.57 (0.53)	2.75 (0.46)	6.00 (0.82)
Slide	1.29 (0.76)	2.88 (0.64)	6.14 (0.69)
Ball Skills Subset Scores			
Two-hand Strike	2.29 (0.76)	3.25 (1.04)	6.86 (0.90)
One-hand Strike	1.43 (0.53)	2.75 (0.46)	6.71 (1.11)
One-hand Dribble	0.86 (0.69)	1.88 (1.13)	5.43 (0.53)
Catch	0.86 (0.38)	2.63 (1.19)	4.57 (0.53)
Kick	1.57 (0.98)	2.38 (0.92)	6.14 (0.69)
Overhand Throw	2.43 (0.98)	3.38 (1.06)	5.86 (0.90)
Underhand Throw	2.14 (0.38)	3.38 (1.30)	6.71 (1.38)
Raw Scores, Age Equivalents, Population Equivalents, and Gross Motor Index			
Locomotor Skills Raw Scores	10.57 (3.26)	17.00 (1.77)	36.29 (3.99)
Ball Skills Raw Scores	11.57 (2.37)	19.63 (6.05)	42.29 (4.79)
Locomotor Age Equivalence	3.30 (0.42)	3.54 (0.41)	7.49 (1.67)
Locomotor Population % Equivalence	<1 (-)	1.50 (0.58)	62.14 (13.46)
Ball Skills Age Equivalence	3.50 (0.71)	4.21 (0.84)	8.25 (1.77)
Ball Skills Population % Equivalence	2.67 (2.08)	5.40 (3.51)	69.14 (15.43)
Gross Motor Index	53.43 (7.02)	57.88 (8.77)	107.43 (5.83)

Motor competence scores (Table 16) show the means and standard deviations between each of the three groups. Data show that severely sight impaired individuals scored lower on every locomotor and ball skill test than their partially sighted and non-sight impaired peers. Overall, GMI mean scores between both severely and partially sighted VI groups were lower than the non-sight impaired group. The extent of those differences was pronounced: Age-matched, non-visually impaired peers had higher GMI scores (M=107.43; ± 5.83), compared to their slightly sight impaired (M=57.88; ± 8.77), and severely sight impaired (M=53.43; ± 7.02).

A two-tailed linear regression (see Table 17) showed no significant relationship between participants' perceived motor competence, physical activity energy expenditure, gross motor index, positive emotional state, or positive outlook. There was, however, a negative correlation between perceived motor competence and social desirability, $r(59) = -.28$, $p=.03$. No significant relationships were found between physical activity expenditure, gross motor index, positive outlook, or social desirability. There was, however, a positive correlation between physical activity energy expenditure and participants' positive emotional state, $r(59) = .33$, $p=.01$. No other correlations were found between data. Whilst important, we must remember that correlation does not imply causation, and so our understanding of these results requires further exploration.

Table 17: *Linear regression between measures*

		TPMC-VI	PAEE	Gross Motor Index	Positive Emotional State	Positive Outlook	Social Desirability
TPMC-VI	Pearson correlation	1	-.17	.16	-.07	.10	-.28*
	Sig. (2-tailed)	-	.90	.57	.62	.44	.03
PAEE	Pearson correlation	-.17	1	-.37	.33**	-.03	.23
	Sig. (2-tailed)	.90	-	.17	.01	.83	.08
Gross Motor Index	Pearson correlation	.16	-.37	1	-.15	.13	.48
	Sig. (2-tailed)	.57	.17	-	.59	.64	.07
Positive Emotional State	Pearson correlation	-.07	.33**	-.15	1	-.13	.08
	Sig. (2-tailed)	.62	.01	.59	-	.30	.55
Positive Outlook	Pearson correlation	.10	-.03	.13	-.13	1	-0.7
	Sig. (2-tailed)	.44	.83	.64	.30	-	.57
Social Desirability	Pearson correlation	-.28*	.23	.48	.08	-.08	1
	Sig. (2-tailed)	.03	.08	.07	.55	.57	-

*. Correlation is significant at the 0.05 level (2-tailed)

**. Correlation is significant at the 0.01 level (2-tailed)

Physical Activity Energy Expenditure was found to have a positive significant relationship, r(59) = .33, p=.01, with positive emotional state in CYP-VI.

Interviews

This section provides analysis of the interview data collected from the family-based interviews and from interviews with industry professionals. Each stakeholder group will be considered independently and then synthesised.

Family-based interviews

This section reports on the salient themes to emerge from the five family-based interviews. Our findings are synthesised with relevant literature to highlight areas of consistency, contrast, and the implications of these for future research. Detailed family profiles and descriptions of the nature of VI of the CYP are provided in Appendix 1, aspects of which will be referred to here to help contextualise experiences. References to family members throughout this section will use the following identifiers, where 'F' refers to the family number (e.g., 1-5), daughters and sons are differentiated by '1' (youngest) and '2' (oldest) and 'VI' indicates participants who are registered either sight impaired or severely sight impaired (see Table 16).

Table 18: *Family-based interview profiles*

Family 1	Family 2	Family 3	Family 4	Family 5
F1 Daughter 1VI	F2 Daughter 1VI	F3 Daughter VI	F4 Son 1VI	F5 Daughter 1VI
F1 Daughter 2	F2 Daughter 2VI	F3 Mother	F4 Son 2	F5 Daughter 2
F1 Mother	F2 Son VI	F3 Father	F4 Father VI	F5 Mother VI
F1 Father	F2 Mother		F4 Mother	F5 Father
	F2 Father			

Family background

All families include a mother and father, both living with the CYP-VI and active in their lives. In Family 2 all three children have the same VI, in Families 1, 4 and 5 the CYP-VI has one older sibling and there were no siblings in Family 3. Two parents (F4 Father VI and F5 Mother VI) also have a visual impairment. The families live in North Somerset

(Family 1), Manchester (Family 2), Cheltenham (Family 3), Lancaster (Family 4) and Oxted (Family), representing a geographical spread across England and all within an hour of a city.

Based on postcode data and using the IMD2019 deprivation deciles (where 1 represents the most deprived 10% of neighbourhoods and 10 represents the least deprived 10% of neighbourhoods) the families live in neighbourhoods representing a range of deprivation from 2 (Family 2) to 10 (Family 1), with an average of deprivation decile of 6.2. All families had a garden and access to local parks or green space. Families 1, 3, 4 and 5 describe their local area as suburban and Family 2 describe theirs as urban but with green space nearby.

All families had use of a car and access to public transport. Families 1 and 5 have regular support from grandparents who live nearby, whereas Families 2, 3 and 4 have extended family living too far away to facilitate regular support. Family 1 have a dog and Family 3 recently got a buddy dog through Guide Dogs. All children are of the age where they are dependent on family support to undertake sport and PA, except for F2 Son VI who, at 17 years old organises his own activity whilst sometimes participating in family-based PA (e.g., hiking).

Nature and impact of visual impairment

Four out of the seven CYP-VI are sight impaired and three are severely sight impaired. All have been visually impaired since birth with the nature of visual impairments described as achromatopsia and nystagmus (F2 Daughter 1VI, F2 Daughter 2VI and F2 Son VI), cone dystrophy and rod dystrophy (F3 Daughter VI), cataracts (F4 Son 1VI and F5 Daughter 1VI) and glaucoma (F4 Son 1VI). Only F1 Daughter 1VI acquired a visual impairment at birth because of another condition, osteopetrosis, which caused damage to the optic nerve.

The impact of VI on family life is evident in all families but the severity varies and whether families include siblings without a visual impairment has a bearing on responses. For example, with no experience of raising children without VI, parents in Families 2 and 3 stress that they have less to compare their experiences to. Similarly, with only one-year age gap between sisters in Family 1, the mother explains *"we don't* *know any different do we, that's the thing" (F1 Mother)*. With all CYP-VI in the sample having had a visual impairment from birth, it can be difficult for parents to determine the impact of it, as F5 Father explains, *"visually it's hard to tell, you know, because she always has had this visual impairment, she just copes with it"*.

Despite this, all families report some challenges in relation to movement, mobility and completing everyday tasks independently. Family 3 acknowledge that F3 Daughter VI learned to walk quite 'late':

> *"I think her physical development, as an infant, was delayed because of her visual impairment but on the flip side of that her vocabulary, understanding and all of that was far and away above her peers and still is... you know, all her teachers and TAs say how articulate she is." (F3 Mother)*

This is not surprising considering significant evidence that children with vision impairment experience delayed onset of different motor milestones, including walking (Hallemans et al., 2011). Families also mention the occurrence of trips and falls, for example, F2 Mother reflects that her children all experienced *"lots of tumbles and falls... I'd say to about 5 years old... they had more than the average"*.

Two of the families with younger children do not regard VI to have had a significant impact but highlight how this can vary. F5 Father recognises that "some days... she's maybe tripping up more, for example, or bumping but on other days you wouldn't know that she had one at all" and F4 Mother comments that *"there are times you notice it and times he just gets on with stuff"*. Interestingly, both of these families also include a parent with VI and the impact of VI may, therefore, be more normalised and less obvious.

All families demonstrate either a desire by the parents to foster independence in their children with VI, or an aspiration of independence from the children themselves. Whilst F3 Mother stresses how they try very hard to make sure that their daughter can do things that are age appropriate, and that F3 Daughter VI is *"keen to be independent"*, one particular scenario highlights the challenges parents can face trying to facilitate independence within the context of busy working lives:

> *"…she found walking any distance so tricky, it was such a battle. Nursery is less than a mile away and to walk home from nursery, it was just horrendous. She was in the push chair a lot longer than she probably should have been because at the end of the day, she'd had a long day, I work in a school for children with severe learning difficulties, you know, I get my hair pulled, I get bitten, I get spat at, I get pood on and I've got to teach them as well as all that… so you know, actually to go and pick her up and then have half an hour battle to get home I was like 'let's just go in the buggy and we'll have a nice time'." (F3 Mother)*

The impact of VI on family life is most prominently felt by Family 1, mainly because of F1 Daughter 1VI being registered blind, recently diagnosed autistic and, therefore, more dependent on family in terms of everyday tasks. The intersection of visual impairment and autism result in impairment effects having complex impacts:

> *"I suppose if we compared us to the average family of four who can go off for a holiday whenever they want or go to Centre Parcs without worrying about anything then it does impact on us quite hard 'cos we've always gotta think 'well is there anything there for [F1 Daughter 1VI] to do, will she have to just sit around and wait for us to do stuff?"*

Consequently, Family 1 tend to restrict their activities to the local area and places that offer security and familiarity for F1 Daughter 1VI.

All families have engaged with relevant support services and professionals and their experiences of these have generally been positive. Although there have been some instances of parents having to fight for support. For example, F3 Mother describes how *"we had to push quite hard for her to start doing the Braille at school"*.

Family 1 faced more significant barriers with their local council, with F1 Mother describing how they had to fight *"to get her a place at a special school"* and also take the local council *"to a tribunal... because they don't wanna pay for anything"*. Whilst F2 Son VI describes being *"very well supported"* through his education and able to reduce support by Year 6 to develop more independence, F2 Mother asserts that he *"received much less support"* in comparison to her younger daughters. All CYP-VI in the sample, apart from F2 Son VI, have EHCPs and discuss general support in the school context favourably.

Engagement with support services has resulted in the provision of various vision aids including canes, magnifiers and assistive technology. The impact of aids has been significant for some CYP-VI, especially in terms of PA. For example, F3 Mother describes getting a cane for her daughter as *"a game changer... we could just then go for a walk whereas before nothing was 'just' anything"*. In contrast F1 Daughter 1 VI has had assistance from Guide Dogs for using a cane *"but she hasn't really grasped the idea of it yet"* (F1 Mother) but this could be compounded by the combination of visual impairment, learning difficulties and autism. F2 Son VI began using contact lenses at age 13 and F2 Mother describes them as having given him *"a new lease of life" and "a lot more independence"*, enabling him to get involved in more activities. She also intends for her daughters to have lenses once they are able to use them confidently, safely and independently.

Informal sport and physical activity in the family setting

Most families regard themselves as at least relatively active, although the COVID-19 restrictions have had some impact on this, both positively and negatively. Families discuss children participating in a range of informal sport and PAs in their gardens or local area, including bike riding, trampolining, walking, running, scootering, roller skating, climbing, basketball and cricket. Some informal PAs are enjoyed as a whole family, whereas others involve families dividing their time. Family 2 describe how, since COVID-19 restrictions began, they have started to go on family hikes lasting 4-5 hours on rough terrain in the Peak District. F2 Mother explains how they bought walking poles and use verbal cues and guiding to support both daughters:

> *"I mean they'll have their stumbles and stuff... we kinda guide, I think with me it's naturally been, from the beginning I gave a lot of verbal cues, so verbally saying 'watch this step [F2 Daughter 2VI]' and 'over here to the left, to the right ...' so we do quite a lot of verbal cues for them to kind of navigate and but we're always close by"*.

F2 Daughter 2VI comments how she enjoys going hiking, especially *"climbing the rocks"* and F2 Son VI provides sibling support by guiding his sisters, with his mother describing him as *"another kind of help... he'll have his few slips and trips but then he'll help the girls as well" (F2 Mother).* Despite describing family hikes as *"boring"* F2 Son VI concedes that *"it's alright, it's fun, it's nice I'm going"*, reflecting the value placed on the whole family being involved. Family 5 describe themselves as *"outdoors people"* who walk regularly, especially since COVID-19 restrictions. As F5 Daughter 1VI conveys, *"... sometimes we go on a picnic walk...Up hills and through woods. [name of hill] is my favourite"*. In addition, F5 Daughter 1VI has been on family skiing holidays in Austria and Italy, where she was enrolled in ski school and ski-ed with her family, with her mother stating, *"she was braver than us"*.

F1 Mother discusses how F1 Daughter 1VI has a strong core and is actually more confident using her body physically on her trampoline and swing than she is navigating around the house, once she has been supported getting to equipment in the garden:

> *"...moving around independently around the house she hasn't been very confident at all but stood in her own space or on a piece of apparatus where she knows where the edges are or she has the ropes on too and she knows where the seat is and she knows where the ground is, and like the trampoline's only an 8ft trampoline so she knows where the edges are, she knows she's not gonna fall out. So she throws herself around in there like nobody's business doesn't she? She's got a space hopper in the trampoline at the moment, so she bounces on the space hopper and on the trampoline." (F1 Mother)*

Most families (2, 4 and 5) refer to riding bikes and report differing success with this. F4 Father VI explains how F4 Son 1VI has learnt to ride his bike with stabilisers and compares his progress with his older brother:

> *"We've got, like, a step thing on the patio, erm, we've put a ramp up and [F4 Son 1VI] learned to cycle up and round it, come back round and do kind of loops. [F4 Son 2] was able to do that a little bit earlier but then children develop at different rates anyway".*

In contrast, Family 5 observe that F5 Daughter 1VI's balance *"is quite amazing, when you see her riding a bike... her balance is better than that of her sister" (F5 Father)*. Whereas trying to get her 7-year-old and 10-year-old daughters to ride a bike is described as *"proving a bit of a challenge"* by F2 Mother, although F2 Son VI, has offered to teach his sisters. In Families 4 and 5 reference is made to the younger sibling with VI imitating or keeping up with their older sibling:

> *"'If there's something brother can do, so can I', or 'I'll give it a go anyway'" (F5 Mother).*
>
> *"They both learned to ride their bikes without stabilisers at a similar age, you know, I suppose [F5 Daughter 1VI] had the incentive that she had to keep up with her big sister so that kind of pushed her on a bit more" (F5 Mother VI).*

These findings corroborate research on sibling influence on sport and PA, with siblings being recognised as role models and potential rivals. In their review of research in this area Kracht & Sisson (2018:8) recognised that siblings may "facilitate activity through involvement in active transport and sport participation by serving as a facilitator and supervision during activity". A small number of studies have reported positive correlations between moderate to vigorous physical activity (MVPA) for youth with VI and their siblings (Ayvazoglu et al, 2006; Haegele et al, 2019a, b, c), leading Haegele et al (2020: no page) to assert that "practitioners and parents interested in enhancing PA among youth with visual impairments should be encouraged to target activities that siblings can successfully engage together".

Some families commonly divide their time to participate in sport and physical activity. For example, while Family 3 often walk their dog as a family, F3 Daughter VI has begun running with her mother near where they dog walk, as the following interview exchange describes:

> *F3 Daughter VI: "We like to go walking out with [dog's name] up to his favourite field."*
>
> *F3 Mother: "And what's special about the field?"*
>
> *F3 Father: "What's new?"*
>
> *F3 Daughter VI: "A running track and I go running... With mum, round the running track."*
>
> *F3 Mother: "And we have our special t-shirts that we wear together don't we... So, I have my guide runner vest ..."*
>
> *F3 Daughter VI: "And I'm the blind runner."*
>
> *F3 Mother: "And what's special about them?"*
>
> *F3 Daughter VI: "That they have our names."*

The family explained how this informal running started mainly as a result of F3 Daughter VI's swimming lessons (which she attended with her father) being suspended. They began running on paths around a nearby lake, but the new running track enables F3 Daughter VI to run independently *"because it has no lumps so I can't trip over bits of grass" (F3 Daughter VI)*. They have since purchased running vests from the BBS website. As discussed in the next section, F3 Daughter VI is taken to climbing lessons by her father who has previously participated in climbing himself.

Family 1 similarly split into smaller units to facilitate participation in sport and physical activities, as F1 Mother describes:

> *"Well [F1 Daughter 2] plays golf so her and dad go off and play golf quite a lot… She plays for the county, so some weekends it will be [F1 Daughter 2] playing one day and [F1 Father] takes her and walks round with her and then he might play the next day because he's a member at the golf club as well so it's me and [F1 Daughter 1VI] on our own sometimes at weekends, most days, most of the weekends, yeah. Erm, so that does take up, that does split us all up quite a lot". (F1 Mother).*

It has been suggested that families of children with a developmental disability means that physical recreation activities usually involved "small combinations of family members – usually mothers and their children" (Mactavish & Schleien, 2004: 123). Whilst F1 Daughter 1VI seemed to spend more time with her mother, she has now begun to participate in golf, like her father and sister, with this being *"something that [F1 Father] could do with her rather than me" (F1 Mother)*.

Formal/structured sport and physical activity provision

The CYP-VI in all families are, or have been, enrolled in formal and structured sport or PA provision outside the family setting. Most have experienced a temporary suspension of sessions as a result of COVID-19 and this has led to trying other more formal activities as a substitute, but all intend to return to sessions once they restart. The structured sport and PA CYP-VI participate in include football (F4 Son 1VI), trampolining (F1 Daughter 1VI), swimming (F1 Daughter 1VI and F3 Daughter VI), golf (F1 Daughter 1VI), horse riding (F5 Daughter 1VI) and climbing (F3 Daughter VI). In addition, F2 Son VI regularly goes to the gym with friends. In these settings one, or sometimes both, parents are present but not physically involved in sessions themselves. This section compares CYP-VI's experiences of mainstream and VI / disability-specific sport & PA provision.

Experiences of mainstream sport & physical activity provision

Most families have tended to introduce their CYP-VI to mainstream activities in the first instance, rather than seek out sessions specifically for children with VI or disabilities, with F4 Son 1VI's football, F3 Daughter VI's swimming and F3 Daughter VI's climbing, all mainstream activities. While F1 Daughter 1VI's swimming lessons take place in a mainstream setting, her parents opted to enrol her in 1-to-1 sessions which she has been attending for 5-6 years. F1 Mother explains that 1-to-1 sessions are preferable because her daughter *"would be in a panic if she was in a swimming pool by herself. So, yeah, the instructor would always get in with her"*. F1 Daughter 1VI no longer goes swimming at the local leisure centre because she now attends a school for children with learning difficulties and goes swimming with school instead.

> *F3 Daughter VI has been participating in the Aquatots swimming programme since she was 3 months old and she has now progressed to their final level 'Advanced Swim School Elite', as the following exchange details:*
>
> *F3 Daughter VI: "Yeah and I've got all my badges."*
>
> *F3 Mother: "You've got your 5m haven't you and your 10m, yeah."*
>
> *F3 Daughter VI: "And then 15m and then 20m and then 25m and then 30, and then 35m..."*
>
> *F3 Mother: "It stops at 25 and then it goes straight to 50 and then it goes straight to 100."*
>
> *F3 Daughter VI: "What?!...Oh I'm not sure I can do 100."*

Her parents are now contemplating their options once F3 Daughter VI completes the Aquatots programme, where a combination of a small pool, small class sizes (six children) and low turnover of instructors who have been attentive to her needs, have enabled her to progress well. As a result, they are more likely to use their Disability Living Allowance to pay for 1-to-1 lessons for F3 Daughter VI due to a concern that mainstream swimming lessons will be:

"very busy and that can be very tricky for her… it's hard to hear anyway and then you've got 20 other kids splashing and making noise… And you've got the instructor in the middle of the pool going 'do this' and you're like 'what is this? I can't see that'." (F3 Mother)

This demonstrates how the multi-sensory nature of sport & PAs can influence the extent to which they are inclusive, with a busy swimming pool environment potentially disrupting the meaningful auditory interactions on which CYP-VI depend.

Other experiences of mainstream provision include F4 Son 1VI's participation in a local football programme, F3 Daughter VI's climbing lessons and F5 Daughter 1VI's horse-riding. The participation of these three children in these specific sports is a direct result of one of their parent's participation and, in F4 Son 1VI's case, his older brother too, as his father explains:

"I grew up playing lots of football and sport… and then [F4 Son 2] started playing football and then [F4 Son 1VI] has… we take [F4 Son 1VI] to a group called Little Kickers on a Saturday morning, erm, and he's been doing that for, about 18 months now… and he also likes going to football training with [F4 Son 2] don't you? So when [F4 Son 2]'s football team trains [F4 Son 1VI] goes with them and gets, joins in quite a lot as well." (F4 Father VI)

Similarly, F3 Daughter VI began attending children's rock-climbing lessons at a local climbing wall because her father had previously participated in rock-climbing and considered it to be a suitable sport, as her parents explain:

F3 Father: "…obviously rock climbing you're right up against it, you can see the holes and so I thought she'd probably quite enjoy it… She's very confident, far more confident than her peers at the same age… If you're blind you could be 10m off the ground, it doesn't matter [laughing], how high you are, you can't see the floor… I think some of it as well is I

> *think we never, there was never any doubt on our part, it was just 'here's a wall, climb it', there was no 'can't do this'."*
>
> *F3 Mother: "And she's been going since she was about 3… her vision is maybe 1-2m depending on how tired she is so actually if you're 2m off the floor, you could be 2m, 10m, 20m and she still can't see the floor, you know."*

F3 Daughter VI exhibits confidence in her climbing ability when asked if she's a good climber by describing herself as *"a good little rock mouse"*. In this case F3 Daughter VI's visual impairment may work to empower her in this particular sport impairment effects are often perceived to be negative in nature and, as Thomas (2004) posits, result in restrictions of activity, but this is an example of how an impairment effect may actually be empowering.

Experiences of sport and physical activity in different settings

Whilst most families have tended to seek out mainstream provision, at least in the first instance, some have had experience of VI or other disability-specific provision. The three families with such experiences have either older children with VI (F2 Family), a child with multiple impairments (F1 Family), or a parent who also has VI (F5 Family). F5 Daughter 1VI became involved in a horse-riding programme specifically for disabled children, leading her to be registered with BBS in order to be classified for competition. F5 Mother VI expresses that competitions for disabled or VI children are likely to provide a safer and *"more fun"* atmosphere *"because she could compete on a more level basis and so that's something we're looking into long term"*. F1 Daughter 1VI has had the most experience sport and PA specifically for disabled children with her participation in disability trampolining sessions at a local trampoline and gymnastics club and golf sessions for children with learning difficulties at a local golf club. The mainstream trampoline club used to have an instructor who specialises in working with disabled children and adults who F1 Mother describes as *"so good he used to really, really take it slow with them all and ease them into it and they built up real trust with them, he was brilliant"*, but the instructor F1 Daughter VI1 has had more recently is regarded less favourably *"he's a bit more blasé and a bit more, like, 'oh just do it' and she used to get quite frightened" (F1 Mother)*. Another issue with the trampolining sessions was a lack of children of F1 Daughter 1VI's age with her usually being the youngest alongside other participants in their early 20s and nobody else with VI, an issue discussed later in relation to VI sport and PA provision.

Family 2 have had the most engagement with sport and PA provision specifically aimed at CYP-VI because of all siblings having a VI and therefore the parents having 17 years' experience of it. For example, the whole family have participated in a range of outdoor activities (including sailing, rock climbing and kayaking) on residential trips provided by VICTA, a national charity providing support to CYP-VI. F2 Daughter 2VI has also enjoyed taking part in a BBS swimming gala. However, F2 Son VI experienced some frustrations with VI sport provision which has resulted in F2 Mother being less motivated to pursue VI-specific provision for her daughters. One issue is feeling as though her children fall in between groups in terms of VI and, therefore, struggle to fit in:

> *"… at times when I take them to clubs there'll be children who didn't have no vision and I felt they, I felt, the kids didn't really fit in there but then they didn't fit in with kids who had vision because they were really disadvantaged. It was like they were in their own little group, but it wasn't being catered for." (F2 Mother)*

This is corroborated by F2 Son VI who explains:

> *"It's a strange in-between group, it's very, it's weird to me [sigh]… we're not completely disadvantaged to the point where we have very little or no sight but we're not at that point where we have full sight." (F2 Son VI)*

The challenge of providing sport opportunities that meet the needs of people with a diverse range of VI has been reported in the modest body of literature on VI sport. For example, Macbeth's (2009) and Powis & Macbeth's (2020) analyses of VI football and cricket recognise that some players, particularly those classified B2, have the potential to be excluded when VI classes are combined. As Powis and Macbeth (2020) assert, the need to combine participants with diverse VI to ensure sufficient numbers for viable sessions / competition can contravene notions of equity and inclusion.

The proximity of VI-specific provision presented an issue to Family 2 when pursuing VI football opportunities for F2 Son VI, an issue commonly reported in research on sport and PA provision for people with VI (Jaarsma et al, 2014). Families who have yet to engage with VI-specific provision all stress they would potentially be interested if there were local opportunities, for example, *“If it was local and we didn’t have to travel too far" (F1 Mother)* and *"...if it was reasonably local, we would definitely give it a go, just to try something new" (F5 Mother VI)*. Another potential barrier to emerge from discussions of VI-specific provision with Family 2 is a lack of opportunities for CYP-VI to participate in sport and PA with children of the same age, as this exchange illustrates:

> *F2 Mother: "...you either haven’t got enough numbers to get involved in it fully or there’s the age group's very vast, when he was younger Action For Blind used to do weekly sessions and he was probably, I’ve been taking him since he was, like, 2, 3, 4 he used to go there.”*
>
> *F2 Son VI: “I was the youngest there.”*
>
> *F2 Mother: “And the rest of the kids were probably 9-10, 11 and upwards.”*
>
> *F2 Son VI: “... best time for, especially, like, a VI kid to get involved with stuff would be between the ages of, like, 14-18, like, that’s probably when you find the most populated kind of groups and stuff. I feel, cos, that’s mainly what the ages of the kids were back then when I used to go when I was a lot younger.”*

F2 Son VI's previous experiences of not having children of the same age within VI-specific sessions validates the perceptions of families who have yet to engage with

VI-specific provision. When asked about whether they have considered pursuing VI-specific provision, it was asserted that *“there's an awful lot there, support there for adults but… the general world seems to have forgotten that those adults start off as children somewhere and have the same issues to deal with before they become adults.” (F4 Mother)*. Similarly, F3 Mother admits to not having conducted much research into VI-specific provision but acknowledges that *"a lot of the VI stuff that we’ve seen is for more younger adults as well.”* Family-based interventions (such as BBS First Steps) have the potential to address such issues and introduce CYP-VI to "a lifelong healthy habit that can improve their fitness and overall health outcomes in the future" (Meera et al, 2020:75). However, the sustainability of such a habit is dependent on there being age-appropriate opportunities for CYP-VI once their participation in interventions end.

When asked about seeking out VI-specific provision, there is acknowledgement from parents of younger children (F3 Daughter VI, F4 Son 1VI and F5 Daughter 1VI) that they anticipate more challenges as they get older and the focus of sport and PE shifts from individual movement-based activities to more team-based activities demanding greater skill and co-ordination and with a more competitive ethos.

> *"… I think as she gets older it might need to be a bit more VI specific in which case we would look into it but at least, you know, we’ve got somewhere to go like British Blind Sport or Sight For Surrey that, you know, they’re really helpful with information on that". (F5 Mother VI)*

> *“I think the issues are gonna come in the next 2 years where she’s at school and her peers are becoming skilled at an activity, be it hockey, football, whatever and it starts then to become more obvious that she could be skilled if she could see it and I think that’s where she will start to possibly get down on herself if we’re not careful, that she’s struggling and particularly if she recognises that she knows what to do but just can’t see it.” (F3 Father)*

F5 Mother VI has similar concerns when discussing whether VI provision would be more suitable for her daughter, with her thoughts clearly being influenced by her own experiences of having a VI:

> *"... we've never said 'you can't do things' but I've really struggled with ball games and, you know, I used to try and play tennis and I could always serve but I could never, ever return it and so, you know, we give her the opportunity to do these things... and it would be nice if she had other children with similar issues to play with, really, they could understand a bit more."*

These perspectives about the appropriateness of mainstream versus VI-specific provision re-emerge in discussions of school-based sport and PE, the focus of the next section.

Experiences of school-based sport and physical education

All CYP-VI began attending mainstream primary schools and this remains the case for all apart from F1 Daughter 1VI who moved to a school for children with learning difficulties from Year 5. Family 5 are currently contemplating moving F5 Daughter 1VI to a school with a specialist VI unit for the following reasons:

> *"... she's sometimes said to us that she doesn't want to be treated differently to other children, erm, so with the treatment that she's getting in school she wants to be one of the gang, if you like and we're strongly considering this, erm, more specialist school because she'll feel like it's ordinary there, the support, rather than extraordinary. " (F5 Father)*

Parents report on their conversations with staff at mainstream schools, with some school staff openly acknowledging they have limited experience of CYP-VI. For example, F4 Mother explains that the school have been very open about this and that having a CYP-VI is a new experience for them. In relation to PE specifically, F3 Mother recalls:

> *"... when she started in Reception her teacher was very good and said 'I think I can cope with everything but I'm a bit worried about PE'... The mobility officer went 'that's fine, I'll come in and observe a PE lesson and I'll give you some pointers'".*

In terms of sport and PE in mainstream schools, families report generally positive experiences, with PE activities being adapted and CYP-VI receiving direct support from teaching assistants. As with sport & PA instructors, families acknowledge the importance of consistency in terms of the members of school staff supporting CYP-VI, enabling them to develop a relationship and better understanding of needs, as F1 Mother explains:

> *"... her experience of sports at school was really positive and she had a great teaching assistant that, at mainstream primary, and they really did get to know her over the years since they were with her in reception, and she had the same ones until year 5. " (F1 Mother)*

Reflecting on his experiences of PE at primary school, F2 Son VI recalls how some activities were less accessible to him, and he was effectively excluded from these activities as they were not adapted to his needs.

> *"... when it came to sports such as cricket, rounders, mainly with smaller objects and stuff like that it was very hard for me to partake in just because tracking a small object and stuff, especially on, like, bright days... with stuff like basketball, erm, football, all that stuff was a lot more accessible to me." (F2 Son VI)*

His experiences of PE at secondary school when he had options to choose from, were regarded as more positive. However, his younger sisters, having EHCPs, have had more positive experiences within the primary school setting participating in rounders, football and martial arts and being taken to VI tennis sessions offsite by sensory services.

Two families (1 and 2) discuss attempts made at mainstream schools for CYP-VI to be included in Sports Day activities. The most effective strategies have involved a combination of being guided by older pupils and parents providing verbal cues. Although F1 Mother describes a situation when F1 Daughter 1VI was not being guided, resulting in a less inclusive outcome:

> *"the teaching assistant was shouting to her to run to her which is hard for [F1 Daughter 1VI] to do, it's easier to hold her hand and get her moving beside you and she will get going, she'll get quite fast but, yeah, voice guidance for [F1 Daughter 1VI] is quite tricky, she's not, if there's sudden distractions, like everybody cheering then it's hard to voice guide her." (F1 Mother)*

A very prominent theme to emerge from discussions with parents of younger CYP-VI is how they anticipate potential challenges their children begin Key Stage 2 and PE becomes more challenging. This mirrors the concerns some parents express in the previous section regarding the appropriateness of mainstream sport and PA sessions in comparison to VI-specific provision.

> *"I think the issues are gonna come in the next 2 years where she's at school and her peers are becoming skilled at an activity, be it hockey, football, whatever and it starts then to become more obvious that she could be skilled if she could see it and I think that's where she will start to possibly get down on herself if we're not careful, that she's struggling and particularly if she recognises that she knows what to do but just can't see it." (F3 Father)*

Although F4 Son 1VI has only been at school for a couple of weeks his parents are apprehensive about PE experiences, leading them to enquire about the availability of information and guidance that they could provide to teachers:

> *"... the last thing we want to happen is in a couple of years' time when other children have gone on and developed that he's left behind and he can't do the things because he's not been able to learn like everybody else... the academic side of it, that is being dealt with... but there's been no physical education, erm, provision made and it's just, you know, what can we do and how can the school help him?" (F4 Father VI)*

Such apprehensions are justified considering research on the experiences of CYP-VI in mainstream school-based sport and PE settings has generally revealed that "while some positive experiences may be available to those with visual impairments, negative feelings toward physical education are more abundantly described" (Haegele, 2020: 49). There is limited research on this topic that explores the experiences of CYP-VI In the UK, an area that clearly warrants further research. This is especially pertinent considering a recent UK-based study revealed that despite PE being popular, it was also the subject in which some CYP-VI felt most discriminated against, as "teachers make decisions without consulting them and isolate them from their friends" (Khadka et al, 2012: 193).

Attitudes towards sport and PA (children and parents)

Consistent with previous findings, parents displayed positive attitudes and appreciated the value of sport and PA in their children's lives (Meera et al., 2020). This also seems to have positively influenced CYP-VI's attitudes towards sport and PA. In contrast with the views of some industry professionals in the next section, there is no clear evidence in this sample of parents being overly protective of their CYP-VI when it comes to sport and PA.

When asked about their approach to parenting a CYP-VI, particularly in relation to sport and PA, all parents stress how they have been keen to provide as many opportunities as possible. In families where the CYP-VI has an older sibling without VI parents assert that they have tried to approach sport and PA In the same way, as F4 Father VI explains:

> *"we took a view that we thought he would develop a lot better doing everything, erm, I don't like to use the word 'normally' but everything that his brother has done basically... when he was 2 we got him involved in the football the same as we did with [F4 Son 2], erm, he has his bike the same as [F4 Son 2], erm, he, there's nothing that he doesn't do or we haven't given him the opportunity to do"*

Similarly, F5 Mother VI and F5 Father discuss the important function of sport and PA in family life:

> *"... they've got to do something physical every day... we both think it's really important to keep physically fit and do something active and not just sit in and watch telly... it's really good for us mentally... I think it is a good opportunity to talk and just spend time together. So, you know, we're very keen for them to, to do at least one sport regularly, whatever they want to do is fine as long as it's something sporty." (F5 Mother VI)*

> *"I think the ethos we all, we always said was whatever they want to try we'll give them a shot at it... if [F5 Daughter 1VI] wants to try something, notwithstanding her vision impairment, we'll try to find a way to let her at least have a crack." (F5 Father)*

Finally, F2 Mother recognises the value of parents empowering CYP-VI especially at a young age:

> *"I think when they were younger, I used to do a lot of outdoor activities with them, so you know you have your play areas... And I'd walk through it step by step, you know, it would be 'right, climb up here one more step'... and I kind of felt like I was empowering them." (F2 Mother)*

Data from the family interviews has indicated that all parents in these families exhibit positive attitudes towards, and appreciate the value of, sport and PA in their children's lives. It should be noted that, as recruitment for interviews was dependent upon voluntary respondent participation, the sample is vulnerable to bias. The families' interest in sport and PA may have been a factor in their willingness to participate in the research and this needs to be acknowledged. It may also explain why these families do not necessarily exhibit the more negative perceptions of parents held by industry professionals that are discussed in the next section. However, these interviews offer a rich qualitative insight into these families' attitudes towards and experiences of sport and physical activity. Furthermore, the in-depth discussions have highlighted the decision-making that is involved in trying to involve their CYP-VI in sport and PA experiences that are inclusive and empowering, in pursuit of lifelong participation. In their review of family-based sport and PA for CYP-VI, Meera et al (2020: 72) recognise that "even though research has been conducted and we have learned that parents of children with VI deem PA important for their children, we still need to learn and explore motives and barriers to PA that these families are facing". These family-based interviews are a valuable first attempt to address a significant gap in the current literature.

“...they exist in this sort of double minority and it’s all of that coming, you know, people talk about falling through the nets, the way I see it is someone’s got the net, but they’ve snipped every other rope, so those holes are huge, and they fall, and they fall a really long, they fall hard, and they fall fast, and they fall frequently and, erm, it’s really quite sad actually.”

Industry professional interviews

Themes from interviews with the industry professionals were aligned with those in the family-based interviews. This likely reflects the professional proximity of industry participants and family-based participants. All industry participants were keen to emphasise that visual impairment is one of the incidences of disability in CYP and many of their responses to questions centred around the issues of getting recognition and support for such a relatively small population. This was compounded by a perception that there is a lack of unity amongst many organisations within the VI sector. Participants suggested that organisations do not agree on many issues, leading to competition amongst organisations for positional or organisational dominance pertinent to “their bit” of work. Though there was a more positive feeling that this was slowly changing, it was still considered one of the most problematic and negative components of the VI sector.

Influence of parents/carers

The influence of parents/carers was suggested to be a critical factor in engagement with sport and physical activity amongst CYP-VI; similar findings have been reported in studies in the United States (Perkins et al., 2013; Stuart et al., 2006) and Guatemala (Columna et al., 2013, 2015). This is also in-keeping with studies in non-disabled populations that details how parents shape the social competencies and peer relationships of their children (Ladd & Pettit, 2002). Indeed, there is a large body of evidence, as discussed in greater detail in the previous section, pertaining to the perspectives of parents and the broader family in promoting physical activity to CYP-VI. However, data from industry professionals highlighted that the influence of parents was, in their experience, a mixture of positive and negative factors.

Participants frequently highlighted that parents were concerned for their child’s welfare where engagement in sport and physical activities was concerned. For example, during a residential trip arranged by their organisation one participant recalled:

> *"I remember the first day the parents were very, very worried and they gave us all their, erm, you know, 'if this child ever needs to pull out then let us know, we'll come and collect her' and so on." (Participant 3).*

These suggestions are in keeping with findings from the broader disability sport literature, whereby parents demonstrate heightened protective feelings toward their child. This was suggested to be more prevalent during early childhood.

> *"I think it goes right back to early years where there's a lot of hand holding, so the other children will be running around, and the blind child will be having their hand held – physically and metaphorically" (Participant 4).*

It was suggested that "hand-holding" practices by parents had detrimental effects, lowering self-confidence and instilling fear in their children, in some cases before activities had been tried.

> *"I mean, parents only have the best of intentions, none of them wants to do something to not help their child but it's the unintentional consequences that are problematic. You can see low confidence and fear in some of the children before they've even tried an activity." (Participant 3).*

This can be explained, in part, by accepting that parents themselves are anxious about and for their children, for a host of reasons, but largely because of a lack of knowledge and understanding regarding the best ways of engaging their child in sport and physical activities (Columna et al., 2015).

> *"We get some very anxious parents come along, for many it will be the first event, erm, that they will have engaged in, the first organisational charity they have engaged with, since finding out about their child's vision impairment. So obviously they'll be very cautious and anxious*

and about what that means for their child as well as, as well as trying to get their head around all the information and everything else that's gonna be thrown at them."

Ultimately, participants highlighted that parents/carers require support in understanding what it is that they can do to help their children develop not only an interest, but the motor competences to be able to feel more confident and better able to participate, in sport and physical activities (Columna et al., 2017, 2019). Moreover, parents often demonstrate a desire and willingness to want to learn, but sometimes there are insufficient means and modes of being able to do this.

"And were prepared to learn. They took one of their, one of their, erm, gym trainers off to do whatever the course they had to do to qualify them to train as a disability gym instructor, they just couldn't have done more really, they were superb." (Participant 4).

"I don't think there is necessarily the right opportunities for helping parents learn how to help develop motor abilities…nothing that I'm aware of, it's another gap in provision, but I don't know who should be ultimately responsible, ya know." (Participant 6).

The role and importance of schools and physical education

Industry professionals all agreed that schools were critical sites for CYP-VI, for multiple reasons. Schools were highlighted as *"the place where they'll get most of their, erm, support in terms of, in all aspects of life." (Participant 1)*. Furthermore, PE has been proposed as the only subject area that CYP-VI engage in that has a remit to develop motor skills and health enhancing behaviours whilst promoting being physically active (Haegele & Lieberman, 2019). However, there are key differences in how children access education. Some CYP-VI will attend local authority maintained (mainstream) schools, whereas others might attend special schools that provide for children with disabilities and special educational needs – these establishments might be private (i.e., fee-paying) or local authority maintained. The education establishment CYP-VI attend will affect myriad other areas of their life, including access to PE, sport, and physical activity opportunities.

Whilst is a growing body of literature concerning CYP-VI and their engagement in PE, these studies have largely been conducted in the USA. This raises several issues: Perhaps most important is that the USA has a National Association for Sport and PE (NASPE) that sets standards and provides direction aligned to overarching guidance provided by the Society of Health and Physical Educators (SHAPE America). As such, PE in the USA focuses more on health-related physical education (HPE), whereas PE in England it is a more heavily contested subject with lack of definitional and operational clarity. Whilst NASPE/SHAPE provides subject focus, the USA does not have a national framework the same as England (i.e., the National Curriculum for Physical Education, NCPE), instead individual states are able to determine the content and focus of their curricula although, as noted above, these are typically informed by NASPE/SHAPE.

Data demonstrated that there was a concern from industry professionals about the focus of the NCPE, suggesting that *"at primary school it works reasonably well with PE"* but that *"it's secondary school when you see it fall apart" (Participant 2)*. Indeed, it was suggested that during Key Stage 1 (i.e., years 5-7 years old) due to all children being in *"the same boat at that age" (participant 3)*, in terms of learning a range of motor skills and competencies, PE worked better for CYP-VI as activities tended to be more individualised and focussed on movement and less on team-based activities.

> *"..it would be targeting them at that fundamental stage, so, like, Reception through to Year 2 is where everyone's motor skills are developed, so that's where PE, erm, typically now, focuses more on games rather than sport and drawing on my past experience as a coach, if you go into a Year 1 session you're not likely to go and play a game of football, you're more likely to do some games and activities designed around, erm, that hand eye co-ordination or for someone with a visual impairment, hand ear co-ordination or tactile co-ordination. I think that is the key, key point and I think that's where,*

> *erm, in my experience, as a sports coach, that's where PE has developed a lot more. You're seeing a lot more, like, real PE is games based rather than sports based, if that makes sense, making sure that those fundamental skills are built up and then people can go down sports specific routes."*

Indeed, participants indicated general approval for how PE during Key Stage 1 supported all children in the development of motor competence. However, they also suggested that as children progress through primary school (i.e., Key Stage 2) and into secondary school, a shift occurs in terms of expectations from teachers; whereby assumptions are made regarding children's motor competence and that they should be able to engage in team-based activities.

> *"… what we find is at primary school it works reasonably well with PE, they do a lot of kind of you know, primary school PE is pretty friendly, erm, bean bags and poles and sticks and stuff, it's all quite small and friendly … Secondary school you might as well forget it. They go ploughing into tennis, hockey, rugby, football …" (Participant 4).*

This, it was suggested, might be due to schools being ill-equipped to engage and support CYP-VI in PE lessons. Consequently, the knock-on effect was that these CYP-VI became disengaged from sport, physical activity, and PE at a critical period of development. This is important because, unlike other maturational processes, the development of gross motor skills does not occur naturally, nor consequently due to the passage of time (Brian et al., 2019; Clark & Whitall, 1989). As such, disengaging CYP-VI at this time might have long-lasting and significant impact upon multiple facets of their lives.

> *"…it can be as simple as a school not being equipped to engage a young person at a young age and we all know any, any person, if they're not engaged at a young age, they're more likely to be disengaged at an older age as well. Erm, or sometimes it's through no*

fault of their own, especially at primary schools if they've not got specialist PE teachers so you can imagine, erm, a teacher that's not a specialist in PE and they've now got a visually impaired child, it's extremely challenging but it's not to say it's insurmountable and there are, on the flip side, there are instances of great practice and how people do engage them at a young age as well." (Participant 2).

Whilst there was discussion of *"great practice"*, this was limited. Participants situated the root cause of these issues in two places: 1) the national curriculum; and 2) during teacher training. One participant was particularly forceful in their feeling regarding the inadequacies of the NCPE in supporting children with disabilities and ignorance of the Equality Act.

"I mean does the National Curriculum, does the National Curriculum actually state anything to do with disability and what disabled children should and shouldn't be able to access? I don't think it does, does it? And then there's the basic, just the basic law of reasonable adjustments in the Equality Act which is, you know, you do have a duty to make this activity accessible to this person unless it can be proven it would be a detriment to the school or the teaching of the other children." (Participant 5)

The ideas underpinning these assertions are well founded. Recent studies have highlighted that there is a gap in the literature in terms of how to prepare PE teachers, sport, and physical activity professionals in how to best include CYP-VI (Columna et al., 2019); and these calls have been made in the broader special educational need's literature for over a decade (Vickerman, 2007).

"…if you go to, if you do a teacher training course you get a module on disability which is probably 1% maybe on visual awareness and…It's tiny in terms of what they cover in physical education terms it's really small." (Participant 6).

This is further compounded by the fact that *"they [teachers] might never teach a VI child because proportionately visual impairment is one of the lowest, erm, disabilities as well."* As such, support for those working in both primary and secondary education might be to focus on ensuring an overall inclusive practice. Indeed, existing literature suggests that there are psychosocial and behavioural benefits to inclusive school-based activities (i.e., PE lessons) amongst CYP with disabilities that includes increased peer support (Goodwin, 2001), friendships (Grenier, 2011), and motor competence (Kalavas & Reid, 2003).

> *"I think it's making sure that inclusion is a focus throughout teaching, which I believe it is, erm, I wouldn't say that teachers don't know how to be inclusive cos they definitely do it's just knowing that, like, teachers know how to teach so if you give them the skills of 'this is how you can teach someone with visual impairment in PE', like, they are going to be able to know how to do it." (Participant 2).*

Although not the direct focus of this project, it is important to highlight that the industry professionals were very critical of secondary school PE, suggesting it is often *"pointless"* for CYP-VI. All participants gave numerous examples of poor practice and difficulty ensuring that CYP-VI were able to access PE lessons.

Prioritising sport and physical activity

The industry professionals involved in this project pointed to the need for parents and carers to prioritise sport and physical activity in their children's lives. All indicated that parents/carers understood there were health-related benefits for their children engaging in sport and physical activity, but that it was often thought of as a *"luxury"* or something they did *"every now and then"*.

> *"…a lot of the conversations that we've had with parents, erm, quite understandably and quite rightly they're, erm, we do a lot of work with parents around EHCP plans and, erm, support around education in*

school and grants and so on and, you know, in a, erm, priority list those things are very high and then, then introducing leisure and exercise and sport stuff starts to become lower down on the priority list."

Consequently, there appeared to be a paradox between what was known to be beneficial in supporting their child's development and what was then prioritised. However, this appeared to be a complex issue, with participants noting that parents are constantly *"fighting"* for things to be put in place for their children (e.g., braille support, teaching assistant support) that they become *"exhausted"* dealing with complex processes and procedures associated with local authority funding, and sometimes being in full time employment, that *"it becomes impossible to do everything"*. This, reportedly, had unintended knock-on effects to CYP-VI where, in some cases, they then viewed sport and physical activity engagement as a luxury activity. This then made engaging those individuals in sport and physical activity more difficult to do.

> *"I mean, children pick up on a lot and when they can see mum or dad getting worked up over things and they can hear that, you know, there are other things more important and then they're getting more push back about PE and sport, they latch on to that and it becomes something else they feel like they can't do." (Participant 1).*

Provision of opportunities

The provision of sport and physical activity opportunities for CYP-VI are broad and varied. Participants highlighted that there are a number of organisations that offer a range of services and opportunities, including sport and physical activity, for individuals and families to engage with. There was a consensus that where opportunities are present, and CYP-VI are *"given the opportunity, they will run away with it."*

> *"...given the opportunities kids, kids love it, like, give them that opportunity to try something new and they love it and it's, like, the*

opportunities aren't always there and I think it's something that I know that people in a position of policy making are aware of in terms of, like, the primary school sports premium that was designed to get more, erm, sport at primary school age and get that engagement through life as the evidence consistently is if they're physically active at 4 years old they'll be physically active at 40 sort of thing." (Participant 3).

There was a suggestion, however, that due to the number of organisations that offer activities (not just sport and physical activities) there is *"noise"* around which organisation does or offers what, especially for parents/carers new to *"the world of VI"*. This was suggested to be an initial hurdle for those parents, and many overcame this relatively quickly. This followed into discussions around the use of taster days by many organisations to engage CYP-VI in sport and physical activities:

"...local sports clubs, centres, leisure centres will put on a taster day, whether it's, erm, sort of pan-disability or whether it's eye specific or whatever it happens to be, have these taster days which they'll put on for free and you can experience, erm, I don't know, Goalball or whatever it happens to be, for free but there are very few of these but then when the child develops an interest and wants to pursue it as any sort of 3-8 year old would want to pursue, whether its football or whatever it happens to be, erm, the parent finds that actually it's quite expensive to go to these clubs and they're usually quite far away as well because there's not very many of them, erm, and the, you know, the potential promise from the taster day, of being able to experience these VI sports, which is great, in reality it doesn't translate into, erm, regular sort of uptake of activity." (Participant 4)

The barriers to more regular participation in sport and physical activities for CYP-VI are well documented (Jaarsma et al., 2014; Scally & Lord, 2019), though this particular example raises broader issues of the provision of CYP-VI sport and physical activity as a whole. Whilst we understand the barriers to participation (i.e., impairment, transport, cost, dependence on others) and the facilitators of sport and physical activity engagement (e.g., health, fun, social contact) how to best operationalise these as a meaningful intervention have not yet been realised.

One of the most frequently cited factors that affects CYP-VI participation in sport and physical activity was "role-modelling" and peer mentoring. It was suggested that parents were important role models in encouraging participation in sport and physical activity; this is seemingly true amongst sighted and visually impaired populations (Rodrigues, Padez & Machado-Rodrigues, 2018). However, parents were suggested to often be reluctant role-models, sometimes wanting to avoid participation in activities with their child(ren).

> *"…any kid does they rely on their parents or family to take them along to sessions if they are part of clubs and things like that and to encourage them to take part. Erm, there's an element of role modelling involved in that as well, erm, which, at our family weekends, erm, the kids go off into their separate groups to have a go at these high ropes and things, but we also make sure the parents do as well. Erm, so there is, we try and do that element of role modelling with the parents taking part in the high ropes as well because they'll more than happily drop off their 7-year-old and then spend the day having a coffee." (Participant 5)*

Whilst parent role-modelling was suggested as beneficial, it was also suggested that peer-mentoring or peer support was a more useful mechanism for encouraging CYP-VI to engage in sport and physical activities. This was more aligned with parents being overly cautious of the activities their children participated in:

> *"Usually, the parents go off and socialise together sort of thing, erm, but then we've had parents that, erm, are, erm, determined to follow their, stay with their child basically…"*

In these situations, it seems sensible that peer-mentoring or peer support approaches might be more beneficial. Particularly as such behaviour from parents has been shown to negatively affect confidence in CYP-VI when participating in sport and physical activities (Stuart, Lieberman & Hand, 2006). However, peer support in this context has not been properly examined, though there have been studies of physically disabled populations and out-of-school physical activity programmes (see Arbour-Nicitopoulos et al., 2017 for a review). It would seem sensible to explore this phenomenon further.

Data from the industry professionals provided unique insight into the facilitation of motor development and engagement in sport and physical activity amongst CYP-VI. Due to the breadth of their roles, participants were able to discuss a broad range of topics and issues, though these did not always have meaning for the population that this project is concerned with (i.e., CYP-VI aged 5-8 years old).

“My general view of school sport is, and there are exceptions, there are a few schools who do it well, particularly at secondary they just don’t really do much and most kids, most VI kids who are doing any sport are doing it out of school.”

Conclusion

This project offers a unique insight into the importance of motor competence upon physical activity engagement, social, and wellbeing for CYP-VI. Data from this project highlight that there are critical issues that need attention from practitioners and policy makers to positively affect the engagement of CYP-VI in sport and physical activity. This includes a focus on motor development during early childhood (i.e., 2-4 years old) that helps to better develop motor competencies that can be transferred into sport and physical activity participation.

Importantly, this project has identified that the amount of physical activity a CYP-VI engages in (as measured by PAEE) has a positive significant relationship with emotional state – that is, the child's emotional wellbeing. This finding points to multiple positive future outcomes for engaging and maintaining CYP-VI within sport and physical activity environments. Similarly, data highlight that CYP-VI spend a substantial amount of their free time engaged in sedentary activities, which has been demonstrated in numerous populations to have negative effects upon health-related outcomes, quality of life, and even life expectancy.

The differences in GMI between CYP-VI and non-sight impaired peers were expected. The extent of those differences, however, was pronounced. Age-matched, non-visually impaired peers had higher GMI scores (M=107.43; ± 5.83), compared to their slightly sight impaired (M=57.88; ± 8.77), and severely sight impaired (M=53.43; ± 7.02). Consequently, intervention during the early years to try and narrow these differences would be beneficial not only for engagement in sport and physical activity, but to support individuals' development and ability to engage in activities of daily living.

An improvement in motor competence, however, might yield an improvement in engagement in sport and physical activity and in doing so, would positively affect the fact that CYP-VI reported spending 91% of their time in sedentary activities. This is a substantial volume of inactivity that has implications for both physical, social, and emotional wellbeing.

Physical education lessons were reported as the activity where most individuals were most physically active. This suggests that schools and PE lessons should be seen as sites of importance in the development of motor competence development and sport and physical activity engagement for CYP-VI. Such suggestions were also highlighted in the qualitative data that were collected. Industry professionals and families indicted that the experiences of CYP-VI during PE lessons became progressively worse: During Key Stage 1, there was less concern for parents with many suggesting that CYP-VI were accommodated for and positively experienced PE lessons. However, as children progressed through school, they became more excluded from engagement in PE lessons, with suggestions posited that teachers were not properly equipped in how to support CYP-VI in their lessons.

This is one of a small number of research projects that has sought to explore the impact of motor competence amongst CYP-VI using multiple methods and focussing on some of the youngest individuals (i.e., 5-8 years old). Much of the previous research has been conducted amongst children and youth aged 9-18 years old (Brian, 2021). As such, this project occupies a unique position to help inform future applied practice, research, and evaluation work. We also acknowledge that additional work needs to be conducted involving younger children to be able to build meaningful activities and interventions that can begin to affect motor competence development and sport and physical activity engagement.

Recommendations & future research

- British Blind Sport should lead the development of an inclusive PE curriculum for Key Stages 1 and 2 that ensures all children are able to access PE and develop the necessary motor competence skills.
- British Blind Sport should position itself as an industry leader in the development of motor development in CYP-VI, building on the First Steps programme and this body of research.
- British Blind Sport should purposefully engage a national sports body to develop CYP-VI specific training and development opportunities for sports coaches and PE teachers.

- British Blind Sport should lead the way in understanding the issues and opportunities associated with PE from Key Stage 2 onwards.
- British Blind Sport should be seen as the industry leader for educational support and resources to inform parents and practitioners around the importance of sport and physical activity participation amongst CYP-VI and across the lifespan.
- That any future interventions are not only evidence-based but have other key-stakeholder involvement (i.e., parents, family, and CYP-VI) that enables a collaborative, co-created process that empowers CYP-VI and the families to advocate for accessible sport and physical activity across multiple contexts.
- Any possible interventions concerned with motor development in CYP-VI should occur as early as possible (i.e., nursery, reception).
- Additional research and evidence are required to understand what families and industry professionals consider to be ‘good’ or ‘best’ practice in physical education for CYP-VI and how this can be developed into intervention programmes or resources.
- Awareness of opportunities - up-to-date details of local, accessible, and inclusive sports clubs with details about age-specific provision (both mainstream and VI-specific).
- Research underpinned by a social-relational understanding of disability which acknowledges the potential for restrictions of activity to result from a complex combination of impairment effects and socially imposed barriers.
- British Blind Sport should petition government to maintain investment in sport and physical activity through school transitions (i.e., primary school key stages; primary to secondary transition; secondary to further; further to higher/work; independent living) to fully support CYP-VI engagement in sport & physical activity.
- Future research in this area should seek to adopt longitudinal designs using repeat measures with the same samples. There are not currently enough high-quality studies of this nature to support evidence-based decision making or fully understand the complex relationship between engagement in sport and physical activity, motor competence development, and wellbeing in CYP-VI.

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Appendices

Appendix 1 Family Profiles

Appendix 1: Family profiles

	Family members	Age of CYP-VI in years	Details of visual impairment	Aids used	Education	Took part in interview?
Family 1 (72 mins)	Daughter 1	10	Osteopetrosis caused damage to the optic nerve resulting in blindness. Diagnosed between 3-6 months. (Also has learning difficulties and recently diagnosed with autism).	Learning to use cane outdoors.	Mainstream until Year 5. Recently moved to special needs school primarily for children with learning difficulties.	No
	Daughter 2	11	No VI			Yes
	Mother	-	No VI			Yes
	Father	-	No VI			No
Family 2 (70 mins)	Daughter 1	7	Achromatopsia and nystagmus. Diagnosed approx. 6 months old.	Red tinted glasses and peaked cap.	Mainstream	No
	Daughter 2	10	Achromatopsia and nystagmus. Diagnosed approx. 6 months old.	Red tinted glasses and peaked cap.	Mainstream	Yes
	Son	17	Achromatopsia and nystagmus. Diagnosed approx. 6 months old.	Filtered contact lenses since 13 years old.	Mainstream	Yes
	Mother		No VI			Yes
	Father		No VI			No

Family 3 (57 mins)	Daughter	6	Cone dystrophy with slight rod dystrophy. Registered blind at 2 years old.	Long cane (plastic ball) within last year, uses outdoors. Buddy dog since March.	Mainstream	Yes
	Mother		No VI			Yes
	Father		No VI			Yes
Family 4 (53 mins)	Son	4	Cataracts in both eyes (congenital). Glaucoma in one eye. Registered severely visually impaired.	Magnification dome and miniature telescope.	Mainstream	Yes
	Son	8	No VI			No
	Father		Cataracts			Yes
	Mother		No VI			Yes
Family 5 (50 mins)	Daughter	6	Cataracts in both eyes (congenital).	Glasses. Laptop at school.	Mainstream but recently applied to school with specialist VI unit.	Yes
	Daughter	7	Slight VI (cataract)		Mainstream	Yes
	Mother		Cataracts			Yes
	Father		No VI			Yes

British Blind Sport

Tel: 01926 424247
Email: info@britishblindsport.org.uk
Website: https://britishblindsport.org.uk/

Thomas Pocklington Trust

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Website: https://www.pocklington-trust.org.uk/

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