Influence of Sports Camps and Vision on Perceived Motor Competence in Children and Adolescents Who Are Visually Impaired

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Structured abstract: *Introduction*: Children with visual impairments (that is, those who have low vision or blindness) often demonstrate lower levels of perceived and actual motor competence and physical activity compared to peers who are sighted. The purpose of this study was to assess the way in which seven-day sports camps specially designed for children with visual impairments affected perceived motor competence as compared to a control condition. *Methods:* Children with visual impairments ($N = 79$), ages 9 to 19 years ($M = 12.71$, $SD = 2.38$) completed either the Self-Perception Profile for Children (ages 9 to 13 years) or the Self-Perception Profile for Adolescents (ages 14 to 19 years) two to three times at two summer camps or at a school for blind students. Two separate 3 (group) $\times$ 4 (vision) ANOVAs assessed pretest and posttest differences for perceived motor competence. A 3 (group) $\times$ 2 (time) $\times$ 4 (vision) repeated-measures ANOVA examined the effects of camp on perceived motor competence from pretest to posttest. Paired samples *t*-tests were conducted to reveal if levels of perceived motor competence remained stable from posttest to maintenance. *Results*: Camp and control groups revealed nonsignificant and similar levels of perceived motor competence at the pretest. By the end of camp one, children improved their perceived motor competence to a much greater and significant degree than did those in the control condition. Similar effects occurred for those who enrolled at camp two, and those participants also revealed significantly greater gains than did those in the control group. A small subsample maintained their gains six weeks after camp one, while control children also remained stable with no change after six weeks. *Discussion*: Children's perceived motor competence can be improved through accessible sports camps. This finding is important, since this measure powerfully associates with physical activity. *Implications for practitioners*: Physical education teachers can model camp conditions to benefit perceived motor competence throughout the academic year.

Children and adolescents with visual impairments (that is, those with blindness or low vision) often demonstrate lower levels of competence in gross motor skills (Haibach, Wagner, & Lieberman, 2014; Wagner, Haibach, & Lieberman, 2013) and physical activity (Haegele & Porretta, 2015) than do peers who are sighted. Motor skill competence is even lower in individuals with very limited vision or total blindness (Haibach et al., 2014). High levels of motor competence are associated with a significantly greater physically active lifestyle and lower body mass index (De Meester et al., 2016), suggesting the importance of developmentally appropriate, context-specific motor skill interventions to improve motor competence.

In addition to motor competence, perceived motor competence is one of the most powerful predictors of physical activity (Babic et al., 2014). It is an individual's personal perception of his or her physical strength, movement capability, capacity for sport, and fitness level (Brian, Bostick, Taunton, & Pennell, 2017; Brian, Haegele, Lieberman & Bostick, 2016; Fox & Corbin, 1989). Unfortunately, children and adolescents with visual impairments also show lower levels of perceived motor competence than do peers who are sighted (Brian et al., 2018). Children with low perceived motor competence tend to opt out of more physical activities because they think their motor competence is not at the same level as their peers (Stodden et al., 2008). Negative relationships have been found between age and perceived motor competence in children with visual impairments, indicating that children's confidence may be decreasing as they become more aware of their motor competence in comparison with their peers (Brian, Haegele, & Bostick, 2016). One's perceptions are often driven by self-comparisons to same-aged peers with regard to any particular sport, physical activity, or gross motor skill (Harter, 1978). As such, it is critical to determine effective methods for improving this competence in children with visual impairments to possibly improve their physical activity levels throughout their lifespan (Brian et al., 2016a; 2016b; 2017).

There are many environmental and instructional barriers to improving perceived and actual motor competence in children with visual impairments. Many physical education teachers do not have adequate preparation time or funding support for modified equipment. Moreover, many have not been trained to work with children with visual impairments (Perkins, Columna, Lieberman, & Bailey, 2013) and lack confidence in doing so (Conroy, 2012). There is also often a lack of communication between physical education teachers and parents in regard to the needs of their visually impaired child (Perkins et al., 2013). Further, parents are often a major barrier to their children's motor development due to overprotecting them and intentionally limiting their exposure and opportunities to be physically active in an effort to decrease their risk of injury (Bouchard & Tetreault, 2000; Shields, Symnot, & Barr, 2012). Parents who do try to encourage their child's motor development often lack the knowledge and understanding of how to teach fundamental motor skills (Columna, Haibach, Lieberman, Fernández-Vivó, & Cordero-Morales, 2016) and do not have modified equipment such as balls with bells or

guidewires (Lieberman, Ponchillia, & Ponchillia, 2013).

Sports camps for children with visual impairments are designed to provide participants with an environment that includes instructors who are knowledgeable about how to modify and teach motor skills and sports activities to these children. Accessible sports camps may provide some visually impaired children with their first experience of playing sports and games with other children with similar levels of vision, and they can provide a positive and safe environment for these children to take risks and learn how to advocate for themselves (Haegele, Lieberman, Lepore, & Lepore-Stevens, 2014). However, it is unclear how attendance at this type of camp affects perceived motor competence. The purpose of this study was to assess the effect of seven-day sports camps specially designed for children and adolescents with visual impairments on perceived motor competence compared to a control condition. Secondary analyses aimed to examine whether results were maintained after one month.

Methods

Participants

Children and adolescents ($N = 79$), ages 9 to 19 years ($M = 12.71$, $SD = 2.38$) served as the convenience sample within this quasi-experimental study. The sample included boys ($n = 44$) and girls ($n = 35$) from two different sports camps in the northeast United States (camp one experimental group = 41; camp two experimental group = 18). Participants in the experimental group attended either public or private schools ($n = 49$), schools for deaf and blind students ($n = 6$), or homeschool ($n = 4$). Our control sample included participants from the southern United States ($n = 20$) who never attended a sports camp. Participants who attended both camps ($n = 7$) count in the sample for camp one only and are also the experimental maintenance group. Only 16 participants remained in the control group from time two ($n = 20$) to time three ($n = 16$). There were 23 participants who were involved in the measures of maintenance. For maintenance, 16 participants remained in the control group from time two ($n = 20$) to time three ($n = 16$). Participants who attended both camps ($n = 7$) were counted in the sample for camp one only, but were used to form the experimental maintenance group.

All participants possessed varying levels of visual impairment (B1 = totally blind, B2 = 20/600, B3 = 20/600–20/200, and B4 = 20/200–20/70; B1 = 11, B2 = 22, B3 = 38, B4 = 15) as classified by the United States Association for Blind Athletes (USABA; see Table 1). The mean ages among groups were relatively similar (camp one = 12.58, $SD = 2.22$; camp two = 13.92, $SD = 2.84$; control = 11.58, $SD = 2.51$; maintenance = 12.43, $SD = 1.25$) (see Table 1).

Setting

Experimental condition

Sport camps one and two were overnight summer programs that each ran for one week for children and adolescents with visual impairments. Each day, campers participated in two sports activities in the morning (such as beep baseball and biking, or track and field and stand-up paddleboard) and two sports in the afternoon (such as goalball and swimming, or

Table 1
Descriptive results for perceived motor confidence by time and vision.

Vision	B1	B2	B3	B4	Total
Pretest (*N* = 79)					
Camp 1 (*n* = 41) (*SD*)	2.23 (.53)	2.93 (.59)	2.55 (.41)	2.54 (.71)	2.59 (.58)
Camp 2 (*n* = 18) (*SD*)	2.68 (.67)	2.67 (.86)	2.93 (.54)	1.60 (0)	2.67 (.66)
Control (*n* = 20) (*SD*)	2.83 (0)	2.83 (.98)	2.67 (.72)	2.92 (.35)	2.75 (.77)
Overall (*SD*)	2.49 (.60)	2.82 (.79)	2.70 (.56)	2.52 (.70)	2.68 (.65)
Posttest (*N* = 79)					
Camp 1 (*n* = 41) (*SD*)	2.84 (.68)	3.34 (.48)	2.88 (.44)	2.97 (.71)	3.01 (.79)
Camp 2 (*n* = 18) (*SD*)	3.01 (.85)	2.86 (.67)	3.06 (.61)	3.00 (0)	2.99 (.64)
Control (*n* = 20) (*SD*)	2.33 (0)	2.69 (.99)	2.45 (.98)	2.83 (.71)	2.56 (.95)
Overall (*SD*)	2.87 (.72)	3.01 (.79)	2.82 (.70)	2.96 (.66)	2.90 (.71)
Maintenance (*N* = 23)					
Camp 1 (*n* = 7) (*SD*)	2.17 (0)	2.67 (.24)	3.50 (.17)	3.07 (.58)	3.07 (.58)
Camp 2 (*SD*)	—	—	—	—	—
Control (*n* = 16) (*SD*)	2.00 (0)	3.00 (.84)	2.23 (.81)	2.83 (0)	2.54 (.84)
Overall (*SD*)	1.90 (.14)	2.94 (.78)	2.35 (.84)	3.21 (.53)	2.67 (.82)

gymnastics and swimming). Each evening, the campers chose recreational sports (for example, fishing; kayaking; stand-up paddleboarding; canoeing; rollerblading; playing basketball; riding a seven-person bike; dancing; and more). Sport specialists (individuals with extensive background and training within each sport) taught all aspects of the various sports and activities to the campers, who each also participated with an individual counselor (all campers received their own counselor for the entire week).

Control condition

Participants in the control condition attended a state school for deaf and blind students in the southern United States. All control participants received daily physical education for 50 minutes, and many participants played on school sports teams (such as goal ball, basketball, or football) but had never attended a sports camp. Two certified physical education teachers taught or coached each physical education class and sports team. The emphasis within the physical education program was on teaching basic movement concepts and fundamental motor skills to the younger children and sports like goal ball and basketball to adolescent students.

Instrumentation

Members of the research team assessed perceived motor competence for all participants enrolled in the study using either the Self-Perception Profile for Children (ages 9 to 13 years; Harter, 2012b) or the Self-Perception Profile for Adolescents (ages 14 to 19 years), Perceived Athletic Competence Subscale (Harter, 2012a). The Self-Perception Profile for Children features a structured alternative-item format with six items on a four-point Likert scale. Participants picked one of two athletic-related scenarios that were most like them (good or not good). Once participants chose a scenario, they then chose whether the scenario was either "sort of true" or "really true" with regard to their athletic competency. Scores were reported between one and four, with one

representing the lowest self-perception (not good, really true) and four representing the highest self-perception (good, really true). The Self-Perception Profile for Adolescents featured the same format as the one for children except that there were only five items. Both batteries typically produce results that are considered valid and reliable, with moderate to strong psychometric properties (Harter, 2012a, 2012b).

Procedures

The Institutional Review Board approved all procedures prior to the start of data collection. At both camps, on the first day parents signed consent forms and children and adolescents provided assent. Parents then completed a short demographic survey with regard to their child. That same day, members of the research team read the age-matched self-perception profile (for either children or adolescents) to each participant individually (time one). Six days later, at the end of camp (time two), members of the research team administered the same age-matched self-perception profile (either for children or adolescents) to each participant individually following the same procedures that occurred during time one.

Seven participants attended both camp one and then camp two, which occurred six weeks after camp one. Those seven participants are included within the analyses for camp one but not for camp two. However, the research team tested the seven repeat campers at the beginning of camp two (six weeks later representing time three for this subgroup) to represent the maintenance effects of camp one.

For the control condition, the physical education teacher at the school for deaf and blind students obtained written consent from each participant's parents as well as verbal assent from each student. Additionally, the teacher completed the same demographic questionnaire completed by the parents in the camp condition. Members of the research team then tested students enrolled in a school for deaf and blind students following the same procedures as the camp conditions. Students ($n = 20$) completed their age-matched (either for children or adolescents) self-perception profile in a quiet space. Members of the research team read each question aloud and participants provided verbal responses.

Participants in the control condition completed their age-matched (either for children or adolescents) self-perception profile three times (pretest, $n = 20$; posttest, $n = 20$; and maintenance test, $n = 16$) following the same timeline as the participants in camp one (six days apart from time one to time two; six weeks later for maintenance) as well as those who attended both camps. During this project, the participants in the control condition received their everyday physical education curriculum from their regular physical education teacher. To our knowledge, no other sport, physical activity, or physical education programming occurred beyond what was considered the control participants' everyday curriculum. For all conditions, participants required approximately five to 15 minutes to complete the self-perception profile.

Data analysis

We calculated descriptive statistics for age, gender, and degree of visual impairment (see Table 1). Next, we calculated two separate—3 (camp one, camp two, control) × 4 (vision)—ANOVAs to examine differences among groups at the

pretest and posttest for perceived motor competence while controlling for age by including the two age groups of children and adolescents as a covariate. Next, we conducted a 3 (camp one, camp two, control) × 2 (pretest, posttest) × 4 (vision) repeated-measures ANOVA to examine the effects of camp on perceived motor competence from pretest to posttest. Afterwards, we conducted two separate paired-samples *t*-tests to examine if those who repeated camps maintained their effects regarding perceived motor competence and if the control participants also maintained these values from posttest to maintenance test.

Results

When controlling for age and including both children and adolescents, there were no significant differences among groups—$F(3, 82) = .69$, $p = .562$, $\eta^2 = .03$—at the pretest regardless of vision—$F(3, 82) = .82$, $p = .489$, $\eta^2 = .03$—for perceived motor competence. Although nonsignificant, participants at camp one ($M = 2.59$, $SD = .58$) and camp two ($M = 2.67$, $SD = .66$) revealed lower levels of perceived motor competence than those in the control group ($M = 2.75$, $SD = .77$; see Table 1 and Figure 1). After six days for both children and adolescents, there was a significant main effect for time—$F(2, 72) = 6.85$, $p = .002$, $\eta^2 = .16$—but not for group—$F(2, 72) = .102$, $p = .903$, $\eta^2 = .00$—or vision, $F(3, 72) = .42$, $p = .743$, $\eta^2 = .02$. Accordingly, improvements occurred across time but not differently between camp one and camp two. There was a significant group × time interaction—$F(2, 72) = 6.85$, $p = .002$, $\eta^2 = .16$—indicating that the experimental groups improved across the six days but that the control group did not. Thus, at the posttest, for both children and adolescents, there was a significant difference among groups—$F(2, 73) = 3.53$, $p = .040$, $\eta^2 = .08$—regardless of vision, $F(2, 73) = .33$, $p = .801$, $\eta^2 = .01$. Participants at camp one ($M = 3.01$, $SD = .79$) and camp two ($M = 2.99$, $SD = .64$) revealed significantly higher levels of perceived motor competence than participants in the control group at posttest ($M = 2.56$, $SD = .95$; see Table 1 and Figure 1).

Maintenance effects

Perceived motor competence levels among those in the maintenance group ($n = 23$) were not significantly different from posttest to maintenance—$t(21) = 1.03$, $p < .313$, $d = .45$. Although not significant—$t(14) = 1.15$, $p = .271$, $d = .61$—control participants maintained their mean scores from time two ($M = 2.56$, $SD = .95$) to time three ($M = 2.54$, $SD = .84$; see Figure 1), but so did the children and adolescents in the experimental group.

Discussion

The purpose of this study was to assess the effectiveness of seven-day sports camps specially designed for children and adolescents with visual impairments on perceived motor competence as compared to a control condition. There were no significant differences at the pretest by condition. A lack of significant difference provides support against the notion that only children and adolescents with higher levels of perceived motor competence would choose to attend a sports camp. Overall, children in the control condition revealed lower levels after the posttest and after the maintenance phase than did their

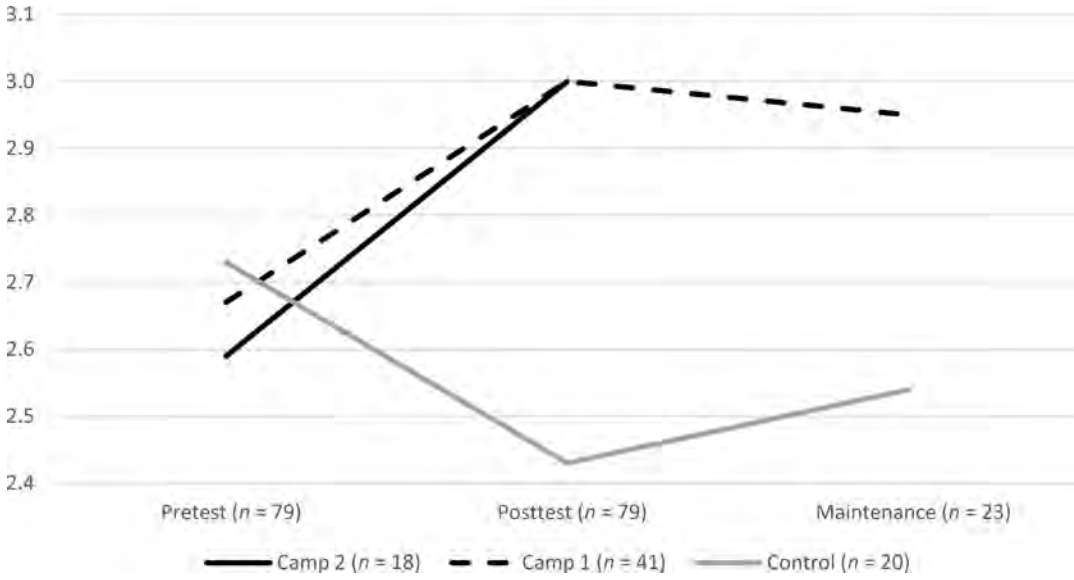

Figure 1. Pretest, posttest, and maintenance effects for perceived motor competence.

peers who participated in either camp. Our results are similar to those found by Shapiro, Moffett, Lieberman, and Dummer (2008), who demonstrated that a week-long sports camp improved the participants' perceptions of their sporting and athletic abilities. Short-term, high-intensity involvement in accessible sports with individualized instruction and assessment may positively affect the perceived motor competence of children and adolescents with visual impairments.

The magnitude of change with which visually impaired children improved perceived motor competence when receiving short-term, high-intensity involvement in sports in a developmentally appropriate manner was alarming because this finding reinforces those of previous studies that have indicated that many children with visual impairments do not receive consistent or appropriate physical activity and sports opportunities in their everyday lives (Perkins et al., 2013; Schedlin, Lieberman, Houston-Wilson, & Cruz, 2012). Clearly, visually impaired individuals need more access on a regular basis to developmentally appropriate, structured sports, physical activity, and physical education.

Perceived motor competence is a very powerful construct that influences choices surrounding physical activity throughout the lifespan (Babic et al., 2014). Lack of physical activity participation is positively associated with the risk of being overweight and obesity (Robinson et al., 2015). Given that children and adolescents with visual impairments are almost twice as likely to become overweight or obese as their sighted peers (Weil et al., 2002), it is critical that they be afforded access to opportunities that positively affect perceived motor competence in order to combat this risk. Sports camps provide acute bouts of engagement time with sports and physical activity in a manner that is developmentally appropriate.

Increased levels of perceived motor competence could possibly be maintained longitudinally, as evidenced by our

maintenance group that revealed higher levels six weeks after camp. However, the effects of camps need to be reinforced through quality physical education, adapted physical education, and community sports programming. Sports camps, if offered more regularly, could assist with more permanent lifestyle changes for visually impaired individuals. Last, physical education teachers can recreate conditions similar to those at sports camps, such as one-on-one instructional situations (with a paraeducator, peer tutors, or adapted physical education supports), accessible sports, assessment of the process and product of the skills, and encouragement to achieve at every step. Offering conditions similar to camp during physical education or in the community throughout the year increases the likelihood that those with visual impairments will increase their perceived motor competence all year long. Moreover, if physical education teachers consult with teachers of visually impaired students, these professionals can support each other in a number of ways. The teacher of visually impaired students can adapt activities for the child so that he or she has more access. In turn, the physical education teacher can assess the ecological validity of his or her activities, thereby maximizing the promotion of physical activity opportunities in which each individual child is most likely to participate.

Despite many strengths within this study, there are limitations present. The participants were from two different regions within the United States. Cultural differences may play a role beyond the control of the research team. Additionally, due to limited sample size, the maintenance group was not the same size as the pretest or posttest group. Finally, our results were limited to the children who actually attended each sports camp. Thus, findings cannot be generalized to children who attend other sports camps and should be interpreted with caution.

Future research can duplicate this study with a larger sample across regions to see if replication occurs. Moreover, future research can assess a collaboration with teachers of visually impaired students, physical education, adapted physical education, and community sports programs that partner with sports camps to work together to achieve longitudinal change for this highly at-risk population. Likewise, future research can assess programs that do not possess variables similar to those at the presently studied sports camps (for instance, accessible sports, assessment of the process and product of the skills, or encouragement to achieve at every step) and compare the perceived motor competence of the children within each program. Finally, future research could assess the actual engagement or the extent to which participants engaged within these activities in each setting.

In conclusion, children and adolescents with visual impairments in this study revealed dangerously low levels of perceived motor competence regardless of condition. In as little as one week, camp participants significantly increased their levels from low to average or high while participating in an accessible sports camp. Gains maintained after six weeks support the idea that positive gains from a one-week camp might persist across time. Future research can assess the influence of a physical education environment infusing the pedagogical concepts from accessible sports camps into their everyday curricula

to foster higher levels of perceived motor competence. Perceived motor competence is a powerful predictor of physical activity choice throughout the lifespan. Thus, greater attention to this construct is needed, particularly for younger children with visual impairments.

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