

# Insight

## Research and Practice in Visual Impairment and Blindness

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**Association for Education and Rehabilitation of the Blind and Visually Impaired**

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**Insight: Research and Practice in Visual Impairment and Blindness**

**A quarterly journal in the field of education and rehabilitation of persons of all ages with low vision or blindness**

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***Insight: Research and Practice  
in Visual Impairment and Blindness***

## **Notice to Authors:**

***Insight*** will cease publication in December, 2012. Because of the number of accepted manuscripts and manuscripts under revision currently in the system, we regret to report that we cannot accept any more submissions at this time. We wish all potential authors the very best in your efforts to publish your work.

– *Insight* Editorial Team

When I review the contents of this issue of *Insight*, I see key words emerging that look like they could be poster-words of encouragement and sustenance for our Association as we move into this year and the years to come: balance, support, mediation, learning, evaluating, and remembering. While each article is about one or more of these concepts, here I am lifting the words to discuss change and change management.

This issue of AER's first ever scholarly journal is also its last in print, and its third last for the foreseeable future. Two more issues, in electronic-only format, will be published before the end of 2012. The Board of Directors of AER made these decisions at the end of January, 2012, for financial reasons.

**Balance.** *Insight* has sought to find a balance between research and practice in its publication of manuscripts. We have also attempted a balance between education and rehabilitation articles; amongst the different key disciplines in the field, and amongst our editorial team. Balance never emerged as more important as when our editors were making final recommendations to me about manuscripts. We showed particular care when rejecting a manuscript to ensure that balanced reviews were provided to authors. Sometimes this would mean disagreement with reviewers, but always there was integrity and the goal of the journal to publish only excellent or potentially excellent submissions was achieved.

**Support.** This journal has received some incredible support over the past four years since its inception. The AER office has faithfully provided assistance to me, through the capable hands, watchful eyes, sympathetic ears, and astute, sensitive, and alert brain of Ginger Croce. Our Associate Editors have worked to support authors and reviewers alike, so that each issue has been a strong reflection of the work undertaken in our field, both in research and in the every-day provision of educational and rehabilitation services to people who are blind or visually impaired. As Editor, I have felt grateful for the support of the Editorial Advisory Board, most especially the kind and smart advice I have received from Dr. Steve LaGrow on the other side of the world. And the ongoing support this journal and I personally received from Allen Press is not measurable. Lindsey Buscher, our Managing Editor at Allen, was professional, knowledgeable, and efficient. She worked well with me and directly with authors. She went

above and beyond the call of duty and the call of the publishing contract, and we cannot thank her enough!

**Mediation.** A scholarly journal, published by a professional association or society, plays the role of mediator. It mediates between the society and its members and potential members; it mediates between the knowledge generators (researchers) and the knowledge users (practitioners). We devoted the years of the journal's life to encouraging this knowledge transfer and exchange in several important and successful ways: 1) we established two theme issues per year, such themes as suggested by members or discerned by me as filling a knowledge hole in our field. Our two consecutive issues on working with children and adults who are deafblind were excellent examples of this achievement, gaining popularity with many professionals and academics who are not members of AER; 2) I developed a workshop on writing for publication that I hosted at many different professional meetings over several years; 3) Allen Press and AER together promoted and distributed the journal at meetings related to our field, and at other meetings. Through the journal, new members often joined us.

**Learning.** The purpose of the knowledge translation process is learning. The goal of the association, through the journal, is to enhance the lifelong learning of its members. By providing a journal to its members, the society provides a teaching and learning tool; the society itself also learns: about what the members are interested in, what the members take the time to study, and what the members feel is important in their respective disciplines. Learning also occurs outside of the field—about all of the above, as well as how the reader who is not a member may best intersect their own field of study or practice with the work being done by members of the association. The learning will not cease with the cessation of *Insight*; but this particular source of knowledge may never look quite the same again.

**Evaluating.** It is time to evaluate what we have accomplished and the brief contributions made by this journal. This is a job best left to the Association and its members. I encourage everyone reading this editorial to take a minute to evaluate the usefulness of *Insight* to you as a professional, and to make note of this thought. You may indicate your thoughts to me by email at [eic@aerbvi.org](mailto:eic@aerbvi.org), and I will relay them

## From the Editor

to the association officers, or you may email them directly to the AER international office or your chapter or divisional representative. Evaluate the effectiveness, the value to readers and authors, and the contribution. Evaluate the place of the journal in our field, or that of any other similar journal. Make your thoughts known; they are important.

**Remembering.** Please don't forget us. Every now and then, perhaps, you will find our articles of use. Occasionally, you may pick up a back issue and browse through. In particular, remember the authors who took the time to submit manuscripts to us, whether or not they were published, and those who worked very hard with us to re-work and revise those manuscripts to massage them in readiness for

publication. Remember our excellence, professionalism, and consistent and timely provision of recent research findings and program examples. Remember our friendly layout and style, and our very popular cover photographs! Please remember that the Association's decision to end the journal is in no way a reflection on its content or contribution.

I look forward to remaining as Editor-in-Chief until the end of 2012 and our last issue. Please stay in touch!



**Deborah Gold, PhD**  
**Editor-in-Chief**



# Supporting Students with Visual Impairments in Physical Education: Needs of Physical Educators

**Paula Conroy, PhD\***

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## Abstract

This qualitative study explored the experiences of physical education teachers in supporting the curricular needs of students with visual impairments in general education physical education classes. Twenty-five physical education (PE) teachers participated in individual interviews for this study. Interview data were divided into three main themes: successes, challenges, and needs. Findings suggest that inclusion of students with visual impairments was a positive experience for both these students and their peers. PE teachers often stated that having students in the general education physical education class encouraged peer interaction and development of social skills and other skills of the Expanded Core Curriculum (ECC). Successful teaching strategies included use of verbal descriptions and physical guidance. Parent participation and support was extremely helpful. PE teachers also reported challenges working with students with visual impairments. These included planning and structuring the class to include the student with a visual impairment as an active participant, a limited number of strategies to draw upon for direct teaching, effective use of peers and paraprofessionals as supports, and consultation with other educational team members including the teacher of students with visual impairments. Needs were similar to challenges but more specifically focused on training. Teachers repeated reports that they needed training in planning and differentiating the curriculum for students with visual impairments in physical education, as well as training about how students with visual impairment learn. Finally, teachers needed strategies for managing peer mentors and paraprofessionals, and for working with parents.

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Keywords: physical education, visual impairments, inclusion

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Regular physical activity can significantly improve one's quality of life. All students, including those with identified disabilities, deserve opportunities to fully develop their physical skills. In 1964, Buell wrote of the importance of physical fitness for individuals with a visual impairment, and stated that physical fitness is even more important for those with a visual

impairment than for those who have normal vision because of the high degree of energy needed by individuals who are blind to carry on daily activities. Research has shown that youth who are visually impaired can gain the same benefits from physical activity as their sighted peers (Adelson & Fraiberg, 1976; Shephard, Ward, & Lee, 1987; Winnick & Short, 1985). Involvement in physical education is important as research has found that those who participate while in school are more likely to be involved in sports after graduation (Ponchillia, Strause, & Ponchillia, 2002).

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## Supporting Students with Visual Impairments

Lieberman reports that the benefits of physical activity have been found to increase skills needed for independence and to improve overall quality of life (2011). Consequently, students with visual impairments should have opportunities to participate in physical activities similar to other students, including those without disabilities, and to have specific activities adapted when necessary to meet their individual learning needs (Lieberman, Robinson, & Rollheiser, 2006; Kalyvas & Reid, 2003; Sherrill, 1998).

## Expanded Core Curriculum

Every student is expected to leave high school with a strong grasp of “core” subjects like math, language arts, science, and history. In order to master these subjects and to eventually live and work independently, however, students who are blind or visually impaired must learn an additional set of skills known as the “Expanded Core Curriculum” (ECC). While sighted children use visual experiences throughout their lives to learn concepts incidentally, students who are visually impaired cannot rely on sensory observations. The foundational skills they need for daily life in school, at home, and in the community must be strategically taught and integrated into all aspects of their education. The ECC areas include: compensatory skills, including communication modes (such as braille, sign language, or tactile symbols); orientation and mobility; social interaction skills; independent living skills; recreation and leisure skills; career education; assistive technology; sensory efficiency skills; and self-determination. The expanded core curriculum empowers students with disabilities to access their education and make their own choices throughout life (Hatlen, 1996), but adequate instruction and assessment on ECC skill areas is lacking (Sapp & Hatlen, 2010). By adding the sport education model into the delivery system, physical education classes can incorporate instruction and practice of skills in all areas of the ECC. Just one activity can be used to teach several components in the expanded core curriculum simultaneously. For example, playing baseball can require the student to read the rules in braille or other media, use orientation skills for directionality, use mobility skills by moving to a destination, develop and use social skills to be part of a team, use a sound device for locating the ball (audition), to tell teammates what he or she needs (self-determination), and help the

student learn about different careers in sports such as sports announcer, journalist, coach, manager, etc. (career education). The game of baseball can also meet physical education curriculum unit objectives and provide a wonderful recreation and leisure activity (ECC area).

## Inclusion

Students with visual impairments were some of the first students with disabilities to be educated in regular classroom settings with peers without disabilities. Beginning in 1900, students with visual impairment were educated in regular classrooms in the Chicago public school system (Holbrook & Koenig, 2000). By 1960, approximately 55 percent of students with vision impairments were being educated alongside their peers without disabilities in regular classrooms across the nation. This figure rose to approximately 75 percent by the early 1970s (Lowenfeld, 1975). Common thinking was that through their placement in a setting with nondisabled peers and support services from the teacher of students with visual impairments, students would learn the ECC in naturally occurring opportunities and situations. However, Correa-Torres and Howell (2004) found that this was not always the case and that the areas of the ECC needed to be directly taught and incorporated into instruction in the general education classroom and curriculum. The current educational model in the United States is one in which the vast majority of students with visual impairments receive instruction in the ECC skill areas by an itinerant teacher of students with visual impairments. This model was used to provide special education services to 87 percent of all students who were visually impaired and received their education in the regular classroom setting (Correa-Torres & Howell, 2004). In this model only 50 percent of the teachers’ time was spent working directly with students, as the time to teach the ECC was limited. Wolffe et al. (2002) found that approximately 40 percent of the teachers’ time was spent on academics, 40 percent on concept development and preteaching, and only 20 percent of teaching time was spent on the ECC. This research indicates that teachers of students with visual impairments lack the time to teach the Expanded Core Curriculum. A more effective instructional model may be for the ECC to be included in general education classes, including physical education.

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The Individuals with Disabilities Education Act (IDEA) defined special education as “instruction conducted in the classroom, in the home, in hospitals, and institutions, and in other settings; and instruction in physical education” (34CFR§300.26). There is a federal call for students with disabilities to be included in physical education in today’s schools. Every student receiving special education services by law must have an Individualized Education Plan (IEP) and the needs of the physical education should be addressed on this IEP. It is important to follow rules of IDEA and ensure that physical education occurs in the least restrictive environment for each student (Lieberman & Houston-Wilson, 1999; Tutt, Lieberman, & Brasher, 2011). The unique needs of the student will provide direction as to how those services will be delivered. Some students may benefit from the adapted physical education class, while other students with disabilities may be able to participate in a regular physical education class using modifications and adaptations as necessary (National Association for Adapted Physical Education Services, 2010). This has created a need for physical educators to learn and use strategies that support the learning of movement concepts of students with visual impairments while including them in physical education classes (Morley, Bailey, Tan, & Cooke, 2010). Recent studies have found that attitudes of teachers have changed and teachers are willing to include students, but need guidance in the use of instructional strategies in order to support students with visual impairment in the general physical education class (Morley et al., 2010; Pearson, 2006). Studies by Lieberman, Houston-Wilson, & Kozub (2002) and Lieberman, Robinson and Rollheiser (2006) found that barriers to including students with visual impairments in the physical education class include lack of training of the physical educator, lack of time, lack of appropriate planning, and lack of equipment.

The intent of this study was to more closely examine how physical education teachers support the inclusion of students with visual impairments in general physical education and to identify strategies that may be of assistance in meeting curriculum-specific instructional needs of the student with a visual impairment in general physical education classes.

### Methods

The Institutional Review Board at the University of Northern Colorado approved this study. All participants

signed an informed consent before participating in open-ended interviews.

### Participants

Physical education teachers were recruited for this study through the Colorado Association of Health, Physical Education, Recreation and Dance (COAH-PERD). This is a professional, non-profit organization composed of educators and individuals in physical education. Prospective participants were presented with information about the study and asked for their participation based on prior experience working with students who were visually impaired (including those who were totally blind). Thirty teachers agreed to participate in the study. When scheduling interviews, however, a total of 25 teachers were able to participate. All teachers were presented with a gift card to a local retailer for their time.

The participants ranged in age from 24 to 62. The total number of years of experience ranged from 3 to 26 years. All participants had experience working with students identified with visual impairments who were included in the general physical education class, but only two had received training specific to working with students with visual impairments.

### Procedure

This study used qualitative methodology, specifically interviews (Patton, 1990). Individual interviews with each of the participants lasted between 1 and 1.5 hours and took place at the school where the teacher was employed. All interviews were audiotaped and an interview protocol was used as a guide (see Appendix). The interview questions were open-ended and participants were encouraged to share their experiences and thoughts outside the protocol. In an effort to promote comfort and to allow room for easy dialogue, the interviews were conducted in an informal manner (Marshall & Rossman, 1999).

### Data Analysis

Each of the 25 interviews was audiotaped. Interview analysis included several steps. Following the interviews, the audiotapes were reviewed and transcribed. The author independently coded each transcript for the identification of any data patterns or themes. This was accomplished by separating the data into smaller pieces of meaningful information then labeling the smaller set with a qualitative description or code. Afterward, a code list was

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created. Next, the code list was analyzed and collapsed into larger themes. To safeguard credibility, 25 percent of the interview data were randomly chosen and coded by an independent researcher with access to the code dictionary. The author and the independent researcher then compared the coded interview data to discuss any agreements or disagreements in the analysis. There were no disagreements over the codes. Themes that emerged from the coding transcriptions and the information included (a) successes, (b) challenges, and (c) needs. Following the identification of the themes, member checks were conducted to further ensure validity of the findings whereby a summary of the thematic areas was presented to a small sample of participants. All participants who participated in the member checks agreed that the three thematic areas accurately reflected the information they shared.

### Results

Themes that emerged from the data were categorized into three main areas: (a) successes, (b) challenges, and (c) needs. The themes in each main area were then subdivided into inclusion and teaching strategies.

### Successes

Physical education teachers reported that having a student with a visual impairment in class was a positive experience for the child with a visual impairment and for peers. Peers helped the student with a visual impairment participate by using a buddy system, giving the student with a visual impairment a verbal or physical cue during games and activities. One teacher shared, “Peers always amaze me by the simple language and discrete cues they use while working with students with visual impairment, there is no tolerance for excuses to not participate in particular activities.” Paraprofessionals were often reported as being an essential component of the inclusive physical education classroom in order to provide safety and to reinforce teaching and practice of skills on an individual basis. Both peer mentors and paraprofessionals were able to help the PE teacher adapt materials and equipment and come up with ideas of how to modify games to include the student with a visual impairment. One participant commented, “When I am fresh out of ideas of how to make an activity meaningful for my blind student who

is also in a wheelchair, I just ask the kids and the support staff and they almost always come up with an incredibly creative way to include the student in the activity.”

Successful instructional strategies teachers reported included the use of verbal descriptions, physical demonstration, and auditory output devices (beeping targets and equipment) to help instruct students. Repetition of directions and extended time to complete activities and movement tasks were commonly mentioned as easy ways to help the student with the visual impairment participate in the class activities. Teachers often stated that, “Parent involvement and support are important in developing movement and background knowledge in the area of physical education.” They reported that parents were able to provide opportunities for practice in movement activities outside of the school day, including involvement in extracurricular sports.

### Challenges

Findings indicated that physical educators experienced several challenges in teaching and including the student with a visual impairment in the general education physical education class. Regarding inclusion, repeated responses centered on the need for an individual paraprofessional to support the student with a visual impairment. One teacher said, “When there is not a paraprofessional present, it is challenging for me to keep the student involved and included in activities.” However, when a paraprofessional was present all of the time, the same teacher reported that she felt the paraprofessional did all of the direct instruction and she was not providing the student support in meeting her educational needs. This difficult balance between the amount of support the PE teacher should provide versus the type and amount of support the paraprofessional should provide was voiced often. PE teachers reported being unsure about the proper selection and use of peer mentors as supports for the student with a visual impairment during class time. They questioned the student qualities they should base their decisions upon.

Participants consistently shared that they initially did not know how to best interact with the student with a visual impairment. They felt that they did not have background information about the specific physical developmental level of the student with a visual impairment who was in their class or the

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student's level of functional vision prior to the student participating in activities. This made it difficult to plan and implement activities in the first weeks of the school year. One teacher commented, "Once I got to know the student and her abilities, it was clear to me what I needed to do to adapt my lessons to help her participate in the activity. Now I feel that I should write a book about all that I have learned." Another teacher mentioned, "I wish I had more information about the student prior to the start of the school year so I could have been more confident in my teaching. Those first few weeks were tough. We did a lot of trial and error."

PE teachers often stated that they did not feel they were always "in the loop" when teaching strategies were discussed, developed and implemented in other areas of the curriculum. An illustration of this was given by a PE teacher of a student with a visual impairment who stated, "I was surprised by the discussion that occurred at the annual review IEP meeting. I did not realize that the educational team was using a preteaching–reteaching approach for teaching academic subjects with this student. I could have easily integrated this into my lessons if I would have known that she would benefit." This lack of communication made it difficult for PE teachers to appropriately develop the structure of lessons that would meet the needs of the student with a visual impairment and to implement effective direct teaching strategies. A consistent response by PE teachers was that consultation with the teacher of the student with visual impairment, or the student's orientation and mobility instructor was infrequent due to lack of time and busy schedules. However, PE teachers viewed this consultation as a necessary component in order to successfully implement the curriculum.

### Needs

Discussing experiences working with students with visual impairments naturally led to physical educators expressing their needs as instructors. All 25 teachers reported that they had training needs, and that many of the challenges in working with this population of learners could be solved with more training. A typical comment was, "If I would have just had background about how students learn without vision, I would be able to come up with many ideas on my own. As it is now, I use a lot of trial and error. This is not best practice." Teachers wanted training in ways to set up the classroom and structure lessons and learning

units to include all learners in order to help them meet physical education standards and the individual needs of the students in the class (including the ECC) simultaneously. One response from a PE teachers was, "I need more information about how students who are blind and visually impaired learn and what they should learn in order to develop relevant lessons. Then, I would love for someone to model how this is done with 30 students in class at one time."

Although many teachers reported that they had received extensive training in the area of inclusion, they still needed training in ways to support inclusion of students with visual impairments in the general physical education class. The need for additional resources for adapting equipment and modifying activities was voiced by the participants over and over. One teacher commented, "I finally researched resources on my own as I felt like the teacher of students with visual impairment was super busy with the braille needs of my student." They also felt they needed financial resources to purchase items that would help the student be more included: "Given an unlimited budget, I would go crazy with adaptive equipment. Because I have no budget, I am becoming more and more creative in how I adapt materials and equipment so all of my students have access." Teachers reported that they needed training in ways of implementing peer mentor programs and in strategies for managing individual paraprofessionals. Finally, teachers reported that the number one resource they needed was time to plan and collaborate with other teachers including the teacher of students with visual impairments. Time with the student on an individual basis was also needed in order to preteach upcoming concepts and skills. One PE teacher shared, "my administrator has been key in providing me with time to better plan for the inclusion of my students. I am not sure I would be able to do this without the extra help."

### Discussion

This study complements other research demonstrating that physical education teachers are willing to include and directly teach students with visual impairments, but do not always know how (Morley et al. 2010; Pearson, 2006). The intent of this study was to examine more closely how physical education teachers support the inclusion of students with visual

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impairments in general physical education, and to identify strategies that may be of assistance in meeting curriculum-specific instructional needs of the student with a visual impairment in general physical education classes. Themes that emerged from the interview data focused on the successes, challenges, and needs of PE teachers in inclusion and instruction.

The teachers in this study reported that they needed training in the use of both internal and external support strategies to improve their teaching and their ability to fully include students with visual impairments in their classes. Internal supports were those that could be used to create an instructional structure with built-in supports to help support the educational needs of all of the students in the class. Differentiating the curriculum and instruction for students in the physical education class is essential. For the student with a visual impairment, this could mean incorporating instruction in the skills of the ECC into lessons and learning units. This support strategy requires the teacher to be master of content knowledge (physical education) and to know the needs of each student in the class well. Differentiated instruction allows PE teachers to support student learning through the design of the lessons and activities and through effective instruction (for more information see Ellis, Lieberman, & LaRoux, 2009).

External supports were outside supports that enabled PE teachers to promote inclusion as well as increase participation of the student with a visual impairment in the physical education class. Teachers interviewed reported that they had a strong need for additional resources as external supports. These resources were time, money, and support personnel.

Time to plan, meet with the teacher of students with visual impairments and other educational team members, and time to meet with the student to preteach concepts were all highly valued by the PE teachers. Unfortunately, time was one of the most frequently reported areas of need. Working with administrators can assist the PE teacher in getting the time necessary to create highly effective educational plans for students. Parents can support the preteaching of concepts and skills by allowing their child to come early or stay after school when necessary. Parents can also help kids to practice learned skills at home in a stress-free environment.

Teachers reported that they needed money in order to obtain equipment and to buy materials to

adapt their own equipment. There are government funds called “quota funds” that can be used to purchase specific educational equipment for children with visual impairments. A list of physical education equipment that can be purchased through quota funds is listed on the American Printing House for the Blind website at [www.aph.org](http://www.aph.org) (click on the PE web site from the home page and then click on “products”). Grants through private foundations are also a great resource for funding of equipment. Teachers need to be encouraged to seek out these funds so that students with visual impairments have access to activities in physical education class. Again, having time to write grant proposals is a challenge.

The powerful role of peers as a support should not be forgotten in physical education as many activities naturally lend themselves to this type of intervention. Peer tutors or mentors can be used to support or guide the student who is visually impaired in a natural way, while also promoting inclusion principles and encouraging the development of social skills and independence (see Carter & Kennedy, 2006; Wiskochil, Lieberman, Houston-Wilson, & Petersen, 2007). While many teachers use peer support models, most use informal means of creating student dyads. It is important that basic guidelines are established regarding how the teacher will pair students and the type and amount of responsibilities a peer mentor will assume.

Individual or classroom paraprofessionals can be used to reinforce the teaching and advance the learning of the student with a visual impairment as well as to ensure safety in the physical education class. Using paraprofessionals effectively is essential in order to avoid unintended consequences that may result from this practice (see Giangreco, Yuan, McKenzie, Cameron, & Fialka, 2005).

## Recommendations for Training

Training of physical educators can occur in personnel preparation programs or be offered as professional development opportunities for teachers who are already practicing physical educators. Four recommendations for training include:

- Training opportunities should be made available for physical education teachers so they

# Supporting Students with Visual Impairments

can become familiar with inclusive practices in a physical education context.

- Physical education teachers should receive training in strategies of using external supports including paraprofessionals, peer mentors, and parents to enhance learning for students with visual impairments in an inclusive physical education environment.
- Background training in how students with visual impairments learn and the importance of research-based teaching strategies for direct instruction is needed in order for physical educators to meet the needs of this unique population of students.
- Training in the Expanded Core Curriculum and strategies for including these areas into physical education classes would help the PE teacher better meet the needs of the student with visual impairment in a way that could carry over into many other areas making instruction authentic, meaningful, and highly motivating.

## Limitations

As with most qualitative research, it is difficult to generalize this study to the larger population. This study contained a small number of teachers ( $N = 25$ ) so interpretations of the findings must be made within the realm of this study. It cannot be maintained that the information and experiences that were shared by these teachers could be generalized to all physical education teachers. The teachers in this study belonged to their professional organization in one area of the country. The findings were specific to the culture of the group they belonged to and the issues they faced within their community and state. Nevertheless, the findings tell the experiences of 25 physical education teachers who would like to improve their ability to teach and include students with visual impairments in their physical education classes.

## Conclusion

Physical education for all children is important to their well-being and a factor of how likely they are to participate in sports after they leave school (Ponchillia, Strause, & Ponchillia, 2002). Children with a visual impairment can gain the same benefits as their sighted peers from physical activities (Shephard, Ward, & Lee, 1987; Winnick & Short,

1985). With the passing of IDEA, inclusion of students with visual impairment is required by law to participate in physical education classes in the least restrictive environment. Physical educators have reported successes, challenges and training needs in supporting the learning of students with visual impairments. Training in how to implement these strategies may assist the physical education teacher to meet the physical education standards for all students, including those with visual impairments.

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## Appendix

### Interview Protocol

1. Demographics:
  - a. What is your age?
  - b. How long have you been a teacher?
  - c. How many years experience do you have in teaching students with disabilities?
  - d. How many years experience do you have teaching students with visual impairments?
2. Please share some of your experiences in working with students with visual impairments in physical education.
3. Describe the instructional strategies or methods you have used to teach concepts and/or curricular components to students with visual impairments in your physical education class.
4. How specifically do you include students with visual impairment in general education classroom? What strategies and resources do you use?
5. Have you received any training specific to working with students with visual impairments? Was it beneficial? If yes, how? If no, why not?
6. Do you have anything else you would like to share on the topic of providing services for students with visual impairments in the general physical education class?



# The Academic Learning Time in Physical Education of Students with Visual Impairments: An Analysis of Two Students

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## Abstract

Motor-skill development is very important for all children, particularly for youth with visual impairments (Houwen, Hartman, & Visscher, 2009; Houwen, Visscher, Hartman, & Lemmink, 2007). Many children with visual impairments are behind on development of motor skills, which are necessary as a foundation for participation in sport, physical activity, and recreation. In this study two participants, both 15 years of age, were video recorded during their physical-education classes for three units each (11 classes). Academic Learning Time-Physical Education (ALT-PE) was analyzed to determine the amount of time the participants were appropriately engaged in activity in both closed and open sport units. Both participants performed below their peers' percentage of ALT-PE in most areas of physical education.

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Keywords: Academic Learning Time in Physical Education (ALT-PE), physical education, visual impairment, motor skills, inclusion

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## Introduction

Motor-skill development is vital for individuals to obtain optimum health while leading an enjoyable and successful life of physical activity. Motor-skill development is defined as "the changes that occur in our ability to move and our movement in general as we proceed through the lifespan" (Payne & Isaacs, 2002, p. 2). Each individual must progress through developmental milestones that will be fundamental in

learning and refining more complex skills throughout the life span. On average, individuals will acquire these milestones in similar sequences and time frames (Payne & Isaacs, 2002).

An individual who refines and progresses his or her development of motor skills is more likely to participate in physical activity throughout his or her lifetime. Motor-skill development is essential for individuals to be able to advance to more complex skills that will be useful from childhood through adulthood and to become and stay physically active throughout their lives. Individuals who are born blind or visually impaired face challenges in their early motor development. This in turn creates greater

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deficits in more specialized movements needed to actively participate in a variety of physical activities (Houwen, Visscher, Hartman, & Lemmink, 2007; O'Connell, Lieberman, & Petersen, 2006).

Physical education plays a vital role in helping students learn and refine their motor skills. The goal of a physical-education program is to assist students in becoming proficient in their movement skills so that they can remain physically engaged throughout their lifetimes. To accomplish this goal, physical educators need to develop lessons that allow for the majority of time in which students are engaged in successful practice of motor skills. Creating such opportunities for both typically developing students and those with disabilities is crucial in attaining this goal.

Physical-education content can be broken down into two main types of skills: open skills and closed skills. Open-skill activities are those in which the variables of the game change constantly, such as basketball, soccer, volleyball, wrestling, and tennis. Closed-skill activities are those in which the variables are constant, such as bowling, archery, running, long jump, and shot put. While typically developing students can see and process the difference in these types of activities, students with visual impairments cannot rely on these types of cues and therefore face unique challenges when attempting to perform both open and closed skills. In addition, due to lack of teacher training, students who are blind or visually impaired do not always receive the correct verbal instruction needed to perform motor skills appropriately, which impacts their ability to be lifelong movers (Houwen, Visscher, et al., 2007; Lieberman, 2011; Lieberman & McHugh, 2001). Lack of physical activity then contributes to a higher risk of developing obesity, diabetes, and other cardiovascular diseases (U.S. Department of Health and Human Services, 1996). Research indicates that children who are born blind or visually impaired have the same potential to develop physical and motor skills as their sighted peers, with all other factors being equal. However, due to lack of opportunity for physical activity, fear of injury, limited expectations, and the absence of informed and trained adults, students with visual impairments experience delays that are entirely avoidable. Further, their lack of activity limits their interactions with peers (Houwen, Hartman, & Visscher, 2009; Lieberman & McHugh, 2001). In addition to outside influences, the visual impairment itself can be a limiting factor in

development. According to Ferrell (2007), "visual impairment has the potential to influence dramatically how children develop" (p. 111). Through promotion of the development of motor skills and physically active lifestyles, students with visual impairments have the potential to become more independent in their day-to-day activities, which also provides greater opportunities to socialize with peers (Houwen, Visscher, et al., 2007; Lieberman & McHugh, 2001).

Physical education provides students with opportunities to develop the necessary skills to become lifelong participants in physical activity. If physical-education teachers use their class time efficiently, there is an increased likelihood that motor skills and an enjoyment of movement will be developed. It is through the development of motor skills that individuals will discover what form of physical activity they enjoy and which activities they will have the confidence to continue participating in after their school careers are over.

Young children need to be introduced to a variety of motor skills, including locomotor (running, jumping, skipping), nonlocomotor (bending, twisting), and manipulative skills (catching, throwing, striking) that promote high levels of Academic Learning Time (ALT). Academic Learning Time in Physical Education, better known as ALT-PE, is the amount of time in a physical-education lesson that a student spends in motor-appropriate activity that yields a high success rate (Siedentop & Tannehill, 2000). The higher the level of motor-appropriate engagement, the higher the level of achievement. Thus, physical-education teachers need to develop their lessons so that students spend most of their time successfully engaged in motor-appropriate skills (Aki, Atasavun, Turan, & Kayihan, 2007; Derri, Emmanouilidou, Vassiliadou, Kioumourtzoglou, & Loza Olave, 2007; Derri, Emmanouilidou, Vassiliadou, Tzetzzi, & Kioumourtzoglou, 2008).

As students progress to the secondary level, motor-skill refinement and the introduction of sport skills and lifetime activities are the focus of the program. If students have not learned basic motor skills in their earlier years, they will continue to lag behind their peers at the secondary level. Programs at the secondary level must continue to help students attain high levels of ALT-PE in order to become competent and proficient movers over their lifetimes (Derri, Emmanouilidou, Vassiliadou, Tzetzzi, et al., 2008).

### Purpose

The purpose of this study was to determine the amount of ALT-PE of students with visual impairments. The following research questions were examined:

- What was the percentage of time students with visual impairments were engaged in ALT-PE in their physical-education classes?
- What was the percentage of time students with visual impairments were engaged in ALT-PE compared to their sighted peers in their physical-education classes?
- What was the percentage of time students with visual impairments were engaged in ALT-PE in open motor skills and closed motor skills during their physical-education classes?

### Methods

#### Informed Consent

Permission to conduct research was granted by the Institutional Review Board of the lead institution. In addition, permission was also granted from the following: the two participants; the parents of the two participants; the parents of the children in the participants' classes; the physical-education teachers; and the school building administrator.

#### Participants

The participants for this study were two students with visual impairments. The male participant, named Cody, was 15 years of age and was a freshman in high school. He had a visual acuity of 20/100, which is considered low vision. The other participant was a female, named Tricia, who was also 15 years of age and a freshman in high school. Tricia has Leber's congenital amaurosis, which is an inherited retinal degenerative disease characterized by severe loss of vision at birth. Her visual acuity was 20/600.

Both Cody and Tricia were in an inclusive physical-education program; however, Tricia had a one-on-one physical-education teacher who worked individually with her a majority of the time, as well as a paraeducator who assisted her throughout the day. Cody did not have any support personnel assigned to him. Tricia and Cody attended school in separate school districts in the northeast United States. They

were selected from a list of individuals who attended a summer camp for students with visual impairments, as well as from teacher recommendations.

#### Procedures

Eleven physical-education classes were observed and video recorded for each participant. The lessons in these classes included both open and closed skills. After classes were video recorded, the principal investigator utilized a modification of the ALT-PE coding sheet (Parker, 1989) to determine the percentage of time the participants spent in each behavior category based on the context of the lesson and learner involvement. The context of the lesson was broken down into general content (transition, management, free time, or warm-up) and subject-matter motor skill (practice, scrimmage/routine, game, or fitness). If the context of the lesson was general content, then the learner involvement fell under the category of "not motor engaged." "Not motor engaged" subcategories included waiting, off-task, on-task, and cognitive. If the context of the lesson was subject-matter motor skills, then the learner involvement fell under the categories of "not motor engaged" or "motor engaged." The subcategories of "motor engaged" included motor appropriate and motor inappropriate. ALT-PE included units where the context was subject-matter motor skills and the learner involvement was motor appropriately engaged. The researchers also added a section on modifications as a third level to indicate any modifications that were given during a physical-education class. A sample of the ALT-PE coding sheet used in this study is found in Table 1.

Observations were made using a 6-second observe/6-second record interval method. During the first 6 seconds the researcher observed the context of the lesson and then the learner involvement, and during the next 6 seconds the researcher recorded both context and learner involvement using preestablished coding abbreviations. If modifications were in place, they were noted as well. To keep observations in the proper order and time, a preprogrammed audiotape was used to indicate "observe" or "record." Both the participants and the class as a whole were observed and recorded to determine the following: (1) the percentage of time students with visual impairments were engaged in ALT-PE during their physical-education classes; (2) the percentage of time students with visual impairments were engaged in ALT-PE



**Table 2.** Percentages and Average Times Spent in Physical-Education Classes Between Participants

	Cody's Class	Tricia's Class
General content		
Transition (T)	33% = 29 minutes	11% = 7 minutes
Management (M)	8% = 8 minutes	12% = 7 minutes
Free-time (FT)	1% = 1 minute	2% = 1 minute
Warm-up (WU)	11% = 10 minutes	0% = 0 minutes
Subject-matter motor skills		
Skill practice (P)	6% = 5 minutes	6% = 4 minutes
Scrimmage (S)	0% = 0 minutes	2% = 1 minute
Game (G)	22% = 20 minutes	40% = 24 minutes
Fitness (F)	12% = 11 minutes	22% = 13 minutes

while the intrarater reliability check yielded a score of 97.3 percent. Both of these scores fell in the acceptable range of reliability.

## Data Analysis

Data were analyzed based on the 6-second observe/6-second record interval recording system and coded on the ALT-PE data sheets. The frequency of occurrence for each behavior category was then counted, recorded, and converted to a percentage. Percentages were determined by dividing the frequency of each behavior by the total number of observed intervals. The percentage of total time in each behavior was then determined by calculating the total time spent in each behavior divided by the total amount of class time. ALT-PE was determined based on the amount of time the participants spent in the context of subject-matter motor skills with learner involvement at motor appropriate engaged. Individual percentages of ALT-PE were determined for the participants with visual impairments; the class averages were also determined to serve as a basis for comparison.

## Results

The purposes of this study were as follows: to determine the average percentage of time students with visual impairments were engaged in ALT-PE in their physical-education classes; to determine the percentage of time students with visual impairments were engaged in ALT-PE compared to their sighted peers; and to determine the percentage of time students with visual impairments were engaged in ALT-PE in open and closed motor skills during their physical-education classes.

Table 2 provides a comparison of average percentages and actual time spent during physical-education classes for both participants. Cody had physical education for an hour and a half, while Tricia had physical education for an hour. In Cody's physical-education classes, the plurality of class time was spent in transition. Transitions do not allow for ALT-PE units to be accumulated. While his classes did average 20 minutes in game play and 11 minutes in fitness, there were no opportunities for scrimmag-

**Table 3.** Average ALT-PE for Students with Visual Impairments

Subject-Matter Motor Skill	Cody's Average % ALT-PE	Tricia's Average % ALT-PE
Skill practice (P)	42	70
Scrimmage (S)	NA	100
Game (G)	87	12
Fitness (F)	47	99

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**Table 4.** Comparison of Average ALT-PE for Cody Compared to His Sighted Peers

<b>Subject-Matter Motor Skill</b>	<b>Cody's Average % ALT-PE</b>	<b>Class's % ALT-PE</b>
Skill practice (P)	42	100
Scrimmage (S)	NA	NA
Game (G)	87	100
Fitness (F)	47	80

es. In Tricia's classes, the plurality of class time was spent in game play, with an average of 24 minutes, followed by fitness, with an average of 13 minutes. There was no time spent on warm-ups in her classes.

Table 3 provides a breakdown of the percentages of ALT-PE the participants obtained. ALT-PE is those units of time when the class is involved in subject-matter motor skills and the individual is motor appropriately engaged.

Cody demonstrated a high percentage of ALT-PE in game play, followed by fitness and the skill practice. However, little time was actually devoted to skill practice in his classes (5 minutes on average). Tricia demonstrated the highest possible score for ALT-PE during the scrimmage portion of class, with 100 percent motor appropriate engagement. However, scrimmage only constituted 2 percent of the total class time. Tricia had a much lower ALT-PE score during game play, which constituted approximately 40 percent of class time.

The percentages of time students with visual impairments were engaged in ALT-PE compared to their sighted peers are depicted in Tables 4 (Cody) and 5 (Tricia). In comparing Cody's ALT-PE to that of his sighted peers, he consistently fell below the class average. The closest comparison between Cody and his classmates was during game play, with a difference of about 13 percent. The biggest discrep-

ancy between Cody and his classmates was skill practice, with a difference of approximately 58 percent, followed by fitness, with a difference of about 33 percent.

In comparing ALT-PE between Tricia and her sighted peers, her class obtained the highest value possible: 100 percent. This is true for every aspect of subject-matter motor skills. Tricia performed comparable to her peers for scrimmage and fitness. Game play was significantly lower for Tricia compared to her peers.

Lessons were broken down into open and closed skills. Open skills were volleyball and badminton for Cody and orienteering for Tricia. The average percentage of appropriate motor engagement of ALT-PE was determined for both Cody (Table 6) and Tricia (Table 7) and for their classes as a whole.

As noted in Table 6, Cody was 100 percent motor appropriately engaged during skill practice time for the 7 minutes it was offered. He was 88 percent motor appropriately engaged during game play, which is relatively high compared to the class's 100 percent involvement for the 31 minutes game play was offered. The classes did not include scrimmage time.

Table 7 indicates that although the unit focus was orienteering, which is considered an open-skill activity, the lesson did not include the subject-matter motor components of scrimmage or game play. In addition, students did not engage in skill practice, so

**Table 5.** Comparison of Average ALT-PE for Tricia Compared to Her Sighted Peers

<b>Subject-Matter Motor Skill</b>	<b>Tricia's Average % ALT-PE</b>	<b>Class's % ALT-PE</b>
Skill practice (P)	70	100
Scrimmage (S)	100	100
Game (G)	12	100
Fitness (F)	99	100

**Table 6.** Average Percentage of ALT-PE in Open Skills for Cody Compared to His Sighted Peers

<b>Subject-Matter Motor Skill</b>	<b>Average % Opportunity for Open Skill</b>	<b>Cody's % ALT-PE for Open Skill</b>	<b>Class's % ALT-PE for Open Skill</b>
Skill practice (P)	8	100	100
Scrimmage (S)	NA	NA	NA
Game (G)	35	88	100

no relevant data were obtained for this portion of the study for Tricia.

Swimming and fitness testing were the closed-skill activities in which Cody participated. A comparison of ALT-PE for Cody and his peers demonstrates that Cody's ALT-PE was significantly lower than his peers' in skill practice and slightly below his peers' in game play.

Recreational pool games and the fitness room were the closed-skill activities in which Tricia participated. Tricia demonstrated her best motor appropriate behavior during skill practice, but her ALT-PE was still somewhat lower than her peers'. ALT-PE in game play was significantly lower for Tricia than for her peers. Tricia was on par with her peers during the scrimmage portion of the lesson, but the time spent on scrimmage was extremely low, constituting only 2 percent of the total time.

In reviewing the data as a whole (Table 4), we see that Cody obtained his highest ALT-PE percentage during game play, followed by fitness and then skill practice; however, these scores remained lower than those of his sighted peers. Tricia obtained her highest ALT-PE percentage during scrimmage; however, it is important to keep in mind that the scrimmage only lasted for 1 minute. Her next highest ALT-PE percentage occurred during the fitness portion of the lesson, followed by skill practice and the game play. Tricia also demonstrated lower ALT-PE scores than

her sighted peers in all components except scrimmage.

Examining the open-skills comparison, we see that Cody did well in both game play and skill practice. Skill practice constituted 8 percent of the lesson and game play constituted approximately 35 percent of the time. Comparisons for Tricia in the open-skills activity did not yield usable data, as the unit chosen and the way in which the teacher presented it did not allow for measures of ALT-PE. According to the closed-skills data, Cody obtained his highest score during game play but was significantly lower in ALT-PE than his peers during skill practice. In both cases, he demonstrated lower ALT-PE scores than his sighted peers. Tricia demonstrated comparable scores to her sighted peers during scrimmage, but as previously noted, this was a small percentage of time spent during the lesson. She did relatively well during skill practice, but that component also was not a focus of the lesson, as only 7 percent of the time was devoted to skill practice. Tricia was far below her peers in ALT-PE during game play.

## Discussion

ALT-PE is those units of time when the context of the lesson is subject-matter motor skills and the

**Table 7.** Average Percentage of ALT-PE in Open Skills for Tricia Compared to Her Sighted Peers

<b>Subject-Matter Motor Skill</b>	<b>Average % Opportunity for Open Skill</b>	<b>Tricia's % ALT-PE for Open Skill</b>	<b>Class's % ALT-PE for Open Skill</b>
Skill practice (P)	NA	NA	NA
Scrimmage (S)	NA	NA	NA
Game (G)	NA	NA	NA

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learner involvement is motor appropriately engaged. When a student is involved in tasks that are appropriate to his or her abilities, the student will demonstrate high success and low error rates, which impacts student learning and achievement (Parker, 1989). It is through a high percentage of ALT-PE that students with and without visual impairments will learn and retain the necessary motor skills to be able to be physically active participants throughout their lifetimes (Derri, Emmanouilidou, Vassiliadou, Tzetzzi, et al., 2008). A discussion of the three research questions examined in this study is presented below.

### Percentage of ALT-PE of Students with Visual Impairments

In the various components of the lesson, Cody's lowest percentages for ALT-PE were skill practice and fitness. One reason for the low percentage of motor appropriate engagement in the aspect of fitness for Cody was that during the fitness-testing unit there was a lot of waiting around during the PACER (running test), push-up, and curl-up tests. Only one partner at a time could go, while the other partner recorded the score. Cody's cardiovascular endurance, muscular strength, and muscular endurance were lower than those of his sighted peers, so he completed his attempts sooner than did his sighted peers. He then needed to wait while his sighted peers were able to perform at a higher level on most of the fitness-test items. This result for Cody was similar to recent findings for health-related fitness of youth with visual impairments (Lieberman, Byrne, Mattern, Watt, & Fernandez-Vivo, 2010; Lieberman, Stuart, Hand, & Robinson, 2006). In those studies, it was found that youth with visual impairments had low passing rates on test items of cardiovascular endurance, upper-body strength, and flexibility.

Tricia had 100 percent engagement in ALT-PE during the scrimmage portion of the lesson; however, the scrimmage portion was only 2 percent of the overall lesson. Tricia demonstrated her lowest percentage of ALT-PE during game play, which took up approximately 40 percent of the class (24 minutes). Based on observation, it was noted that Tricia's instructors (one-on-one physical educator and paraeducator) did not have any specific goals for Tricia to accomplish during that time period; therefore, she was given little opportunity to partici-

pate. Lieberman, Stuart, Hand, and Robinson (2006) suggested that successful experiences of physical activity for students with disabilities are contingent on factors that are related to teachers' preparation and attitudes, as well as perceived and actual barriers to instruction. Houwen et al. (2009) examined the development of gross motor skills in students who are blind and students who are sighted and indicated that it is essential to provide individuals with visual impairments the necessary interventions in motor-skill development and to not allow mere maintenance or especially regression of those individuals' motor-skill development due to the lack of opportunity to move. The opportunity to move at a young age sets the stage for becoming a physically active adult. Regardless of how much motor appropriate engagement in ALT-PE is provided, if students with visual impairments are not given the necessary tools to learn, develop, and progress in their skill development, they are not able to enter into society with the knowledge of how to remain physically active. It may be due to these barriers that Tricia was not given the opportunities for successful skill development. In addition, since she was not held accountable for her learning, she chose to socialize and not readily engage in the activity, with no consequences.

### Percentage of ALT-PE of Students with Visual Impairments Compared to That of Their Sighted Peers

The percentage differences of ALT-PE for Cody and his class as a whole ranged from 13 to 86 percent. The largest percentage differences were in skill practice and fitness. The percentage of ALT-PE for the class as a whole in fitness was 80 percent, compared to Cody's 47 percent. This goes back to the low percentage for both Cody and his class due to how the fitness-testing unit encompasses a lot more waiting than actual participation from the students. Game play had a difference of about 13 percent, allowing Cody to use the skills he had learned throughout the lesson and apply them to real game settings. Skill practice only came to approximately 6 percent of total overall opportunity for ALT-PE; in this area there was a 58 percent difference between Cody and his class. These results are compelling and similar to those in a study conducted by Derri, Emmanouilidou, Vassiliadou, Kioumourtz-



glou, and Loza Olave (2007) that examined ALT-PE and its possible relation to fundamental-movement skill acquisition and learning. The findings indicated that “in order to increase academic learning time teachers should learn to place emphasis on the critical cues of fundamental movement skills, and be aware of the importance of their teaching so as to become more effective” (p. 21). The extreme difference between Cody and his class as a whole in skill practice could be due to the physical-education teacher’s assumption that each individual student already had the skills necessary to jump right into game play. In badminton Cody could not track the shuttlecock. With his visual impairment, the size and color of the birdie blended into his environment, making it hard for him to track and make successful contact with his racquet. The attention to students’ individual needs is imperative, because if students do not feel comfortable with their skills they will not seek out opportunities outside of physical-education class to pursue physical activity as a lifestyle (Lieberman, 2011; Lieberman, Houston-Wilson, & Kozub, 2002; Stuart, Lieberman, & Hand, 2006).

Tricia and her class as a whole had ALT-PE percent ranges from 12 to 100 percent, with the largest difference in game play. Tricia’s ALT-PE for game play was approximately 12 percent, compared to her classmates’ 100 percent. Game play constituted 24 minutes of the total 60-minute class time, or 40 percent. Research indicates that individuals with visual impairments have a significant delay in developing motor skills from birth and that the individuals with the least amount of vision produce the poorest motor-skill outcomes (Celeste, 2002). The extreme differences between Tricia and her peers can be attributed to Tricia’s visual impairment, as her level of motor-skill development is below those of her sighted peers. In addition, based on observations during this study, it was clear that Tricia did not receive the necessary modifications for her to advance in her skills. For example, during an orienteering lesson there was no guide wire, no tactile map, no peer guide, and no other accommodations made for her needs. Despite the fact that Tricia had a one-on-one physical-education teacher and a paraeducator, they were not providing her with the type of instruction, support, or modifications necessary to successfully allow her to develop and refine her motor skills. This lack of programming will likely decrease her possibilities of

finding activities to actively participate in outside of her physical-education setting (Stuart et al., 2006). Based on the findings of this study, both Cody and Tricia could use additional instruction, support, and modifications to help close the gap between their performances and those of their sighted peers.

### **Percentage of ALT-PE of Students with Visual Impairments in Open and Closed Skills Compared to Their Sighted Peers**

Badminton and volleyball were the two open-skill units Cody was engaged in during the time of observation. Cody’s motor appropriate engagement in game play was 88 percent, which took up approximately 35 percent of total class time. Cody was 100 percent motor appropriately engaged in skill practice, which accounted for 8 percent of total class time. Comparing how time was spent in class, transitions took up approximately 33 percent of class time. Clearly more time should have been spent on skill practice. As the literature has indicated, teachers need to decrease management time by improving class routines, and improve lesson focus with the goal of improving student ALT-PE (Lacy & LaMaster, 1996). It would make sense that if the physical-education instructor took more time for skill practice and less time for management, not only would the student with visual impairment benefit, but the entire class as a whole would benefit from further progression of skill development.

Swimming and fitness testing were the two closed-skill units observed for Cody (Table 8). There was more of a discrepancy here between Cody’s ALT-PE and that of the class as a whole than with open skills. Game play yielded Cody’s highest percentage of ALT-PE, with skill practice and fitness (totaling an average of 28 minutes of total class time) the lowest. Again, the largest percentage of class time was spent in transition at 33 percent. It would be most beneficial for transition to not take up the plurality of class time, and for class time instead to be used to work on much-needed skill development.

Recreational pool games and the fitness room were the two closed-skill units observed for Tricia (Table 9). The highest percentages of ALT-PE for Tricia were scrimmage and skill practice. The lowest percentage of ALT-PE was game play. This low

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**Table 8.** Average Percentage of ALT-PE in Closed Skills for Cody Compared to His Sighted Peers

<b>Subject-Matter Motor Skill</b>	<b>Average % Opportunity for Closed Skill</b>	<b>Cody's % ALT-PE for Closed Skill</b>	<b>Class's % ALT-PE for Closed Skill</b>
Skill practice (P)	1	14	100
Scrimmage (S)	NA	NA	NA
Game (G)	10	83	100

percentage is significant due to the fact that the class as a whole obtained 100 percent ALT-PE. Tricia could have benefitted from more effective teaching strategies to help her increase her ALT-PE. As Lacy and LaMaster (1993) indicated, "it is vital that intervals of silence are incorporated with active monitoring and increased instructional feedback to individual students to increase academic learning time" (p. 24).

Students with visual impairments clearly need well-trained teachers who can prepare appropriate lessons, utilize effective teaching strategies, and plan for modifications to accommodate the unique needs of these learners. This study demonstrated not only that students with visual impairments have generally lower ALT-PE scores than their sighted peers, but that the lessons observed were not always well thought out and that too much time was wasted in such things as transitions and management. Physical educators play an important role in providing all students with opportunities to develop motor and fitness skills that promote healthy, active lifestyles.

### Limitations

The limitations of this study were that there were only two participants. Both participants were high-school age. Although there were six units covered, with a combination of open and closed skills, the findings are difficult to generalize to all students with visual impairment. It is the hope of the researchers

that these findings will be a step toward improving physical-education programming for youth with visual impairments.

## Conclusions

ALT-PE is a useful tool to assess learning in physical education. Based on the findings of this study, the participants generally had lower ALT-PE scores than their sighted peers. Consequently, it is up to the physical educator to provide lessons that use time effectively and provide the necessary accommodations to help students with visual impairment achieve movement goals and further prepare them for participation in lifelong physical activities.

The findings in this study demonstrate that even a student with low vision is capable of falling through the cracks if he or she is not observed for potential needs and modifications to the lesson. During badminton, although Cody is an athletic individual who likes to participate in physical education, it was apparent to the primary observer that the shuttlecock needed to be a brighter color other than white. Cody would continually try to hit the shuttlecock with correct form, but more often than not would completely miss his target. It is believed that this had to do with his not being able to track the shuttlecock due to the color's blending in with the background. If the shuttlecock were a bright yellow, it

**Table 9.** Average Percentage of ALT-PE in Closed Skills for Tricia Compared to Her Sighted Peers

	<b>Average % Opportunity for Closed Skill</b>	<b>Tricia's % ALT-PE for Closed Skill</b>	<b>Class's % ALT-PE for Closed Skill</b>
Skill practice (P)	7	70	100
Scrimmage (S)	2	100	100
Game (G)	45	12	100

would be easier for Cody to track. A larger training shuttlecock might also have been an easier target for Cody to track and ultimately find success with. When observing Cody in the swimming pool, it was apparent that without his glasses on it was difficult for him to determine his surroundings. Constant squinting and rubbing of the eyes occurred, and because of this Cody seemed to have a hard time paying attention to directions and ultimately became a distraction to the class, causing the physical educator to need to stop and wait for Cody to get back on track. If the physical educator had taken the time to talk with Cody and find out what his needs would be in the pool prior to the unit, it would have ultimately made both Cody's and his physical educator's time in the pool more enjoyable and created a better learning environment for all.

In Tricia's case, her vision played a major role in how she participated in her physical-education class. Tricia stated to the primary observer that she did not like physical education or activity to begin with, so it was even more difficult to get her excited about physical-education class and what it has to offer. Even with Tricia having a one-on-one physical educator and a paraeducator, neither one of them took the initiative to modify lessons so that Tricia could fully participate in the activities of the class. During the unit on recreational pool games, both the one-on-one physical educator and paraeducator stood on the side of the pool and talked with other colleagues rather than engaging with Tricia. Tricia spent the majority of her time not being productive in any of the activities offered to the class, such as kayaking, water polo, basketball, and other pool games. When Tricia was pushed to play water polo, she stayed to the side of the pool, treading water and talking with a friend while the game was going on. Again, there was no direction from the physical educator or paraeducator. The fitness room was where Tricia felt most comfortable and stayed motor appropriately engaged in ALT-PE for the majority of the class period. This is attributed to the fact that she was on the treadmill and elliptical machine for the entire class period. There was no need to worry about her environment because she was stationary, and she did not feel uncomfortable with her skill level because she was working independently. Tricia said she did not get any physical activity at home.

This study demonstrates that if students are not receiving enough motor appropriate engagement in ALT-PE, the development of skills necessary to become lifelong participants of movement may not take place. It is seen with both participants of this study that not enough skill development was provided within each unit, and that even when it was provided, both students with visual impairments participated at a lower rate than their sighted peers. In addition, it was demonstrated that modifications to instruction, the environment, and equipment were not made to allow for success. Physical educators need to become aware of the amount of time they are spending on each aspect of their physical-education class. They need to talk with their students with visual impairments to find out what modifications would be useful to make them more successful and help them ultimately find enjoyment from the physical activities they have learned in physical-education class so that they can take that knowledge into society and become lifelong participants of movement.

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# Evaluating the Effects of Homonymous Hemianopsia on Mobility: Considerations from a Case Series

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## Abstract

Homonymous hemianopsia is a significant visual impairment associated with stroke and traumatic brain injury. This bilateral loss of visual field to one side impacts one's quality of life and ability to ambulate safely through the everyday environment. Rehabilitation providers seek evidence-based treatment strategies for improving the mobility of patients with homonymous hemianopsia. This case series of individuals with homonymous hemianopsia explores the effectiveness of prism, orientation and mobility, and visual scanning training.

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Keywords: homonymous hemianopsia, mobility, prism

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## Introduction

Homonymous hemianopsia (HH) is a significant visual impairment that can be associated with cerebral vascular accident (CVA) and traumatic brain injury (TBI). It is estimated that 795,000 Americans have a new or recurrent stroke each year (American Heart Association, 2010). Consequentially, as many as a third of these experience HH or hemi-neglect (Pambakian & Kennard, 1997). Bruce, Zhang, Kedar, Newman, and Biousse (2006) reported that 12 percent of patients with TBI were found to have HH.

The classic functional effect of HH is that the lateral visual field in one direction is absent in both eyes (e.g., to the left, to the right). HH causes significant difficulty with activities of daily living including reading (Trauzettel-Klosinski & Brendler,

1998) and mobility (Salive, 1994; Zihl, 1995). Persons with HH are unable to drive legally (Szyk, Brigell, & Seiple, 1993; Szyk, Seiple, Stelmack, & McMahon, 2005). In addition, these individuals are at significant risk for accident and secondary injury (Nooney, 1986; Rapport et al., 1993; Webster & Abadee, 1995). Although recovery of vision is sometimes seen following stroke or brain injury, after several months visual-field recovery becomes rare (Zhang, Kedar, Lynn, Newman, & Biousse, 2006). Therefore, development of compensatory strategies plays an important role (Zihl, 1995).

Previous studies have demonstrated that mobility problems are common in individuals with HH (Zihl, 1995, 1999) and include difficulty detecting people, obstacles, and locations (Laderman, Szyk, Kelsch, & Seiple, 2000); avoiding obstacles and people (Zihl, 1999); and ability to travel safely (Mancil et al., 2005). Relatively few rehabilitation strategies and devices have been developed to improve mobility in this population.

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## Mobility Rehabilitation for Homonymous Hemianopsia

Walking speed measurements have been used to quantify mobility performance in individuals with visual impairment. Attempts have been made to correlate walking speed with the amount of remaining vision in order to determine which clinical tests best predict mobility performance (Dodds, Carter, & Howarth, 1983; Geruschat & De l'Aune, 1989; Hollyfield & Trimble, 1985). The Percentage of Preferred Walking Speed (PPWS), introduced by Clark-Carter, Heyes, and Howarth (1986), is the percentage expressing the ratio of real-world walking speed to the ideal speed that individuals would walk if they were normally sighted. PPWS has been used previously in numerous studies and has been shown to correlate with clinical measures of residual vision and mobility (Beggs, 1991; Geruschat, Turano, & Stahl, 1998; Hartong, Jorritsma, Neve, Melis-Dankers, & Kooijman, 2004; Hassan, Lovie-Kitchin, & Woods, 2002; Haymes, Guest, Heyes, & Johnston, 1996; Jones & Troscianko, 2006; Mancil et al., 2005; Patel et al., 2006; Turano, Geruschat, Stahl, & Massof, 1999). In the Salisbury Eye Evaluation, Patel et al. (2006) described the association between reduced visual field and reduced mobility using PPWS.

Optical therapy for HH patients involves prescribing prisms and training in visual scanning strategies in order to use remaining vision to travel more safely (Pambakian & Kennard, 1997). Some have proposed that patients with HH who regain awareness of their environment may experience a reduced period of convalescence and that their risk of secondary injury may be lessened (Nooney, 1986). Despite their frequent use, the techniques involved in optical and eye movement rehabilitation for HH have not undergone rigorous evaluation, and these treatments are inconsistently applied. Only a few small-scale studies have evaluated the effectiveness of common prism treatments (Giorgi, Woods, & Peli, 2009; Gottlieb, Freeman, & Williams, 1992; Peli, 2000).

An additional experimental rehabilitation technique known as visual field restitution involves the practice of detecting stimuli with the blind field. Various techniques have been utilized to explore the visual system's potential for neuroplasticity, and research in this area has been summarized recently by Schofield and Leff (2009). Visual field restitution is not yet a commonly applied rehabilitation technique and warrants further study.

In addition to impaired mobility, reading disability is common with HH (Trauzettel-Klosinski & Brendler, 1998). Severely reduced reading speeds have been associated with reduced reading-related quality of life measures in this population (Gall, Wagenbreth, Sgorzaly, Franke, & Sabel, 2010).

## Design of a Case Study

A record review identified five patients with complete HH who were ambulatory and who had not previously been prescribed a prism system.<sup>1</sup> A group of 12 participants with normal sight and normal walking mobility were identified to complete the same measures for comparison purposes. The study protocol was reviewed, approved, and monitored by the Hefner VA Medical Center Institutional Review Board. Medical clearance was obtained from each participant's primary care provider, and all participants completed an informed consent process. Each participant was required to be ambulatory with walking mobility (i.e., a support cane or walker was allowed but a wheelchair was not).

Participants completed the Mini Mental State Examination (MMSE) and Beck Depression Inventory (BDI-II). The required score was at least 50 out of 57 on the MMSE (indicating the participant was cognitively intact) and lower than 20 with the BDI-II (higher scores indicate moderate or severe depression) (Beck, Steer, & Brown, 1996; Beck, Steer, & Garbin, 1988). Each participant completed these evaluations and met these requirements. Unilateral spatial neglect (USN), a failure to attend and respond to stimuli, sometimes occurs after CVA and may coexist with homonymous hemianopsia (Bowen, McKenna, & Tallis, 1999; Heilman & Valenstein, 1993). USN was excluded for each HH participant

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<sup>1</sup>The study group reviewed records and identified 48 unique patients with a diagnosis of homonymous field loss who were examined within the past 3 years. After review, only five patients were identified as potential participants. A majority of patients identified with complete hemianopsia were not ambulatory and had significant comorbidities that excluded their participation. Transportation to and from research appointments also limited participation because persons with hemianopsia are not legally able to drive in North Carolina.

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using free drawing, copying, and line cancellation (Schenkenberg, Bradford, & Ajax, 1980) testing.

Measures of vision for each participant were obtained including Snellen visual acuity and Humphrey Matrix perimetry. Adopted walking speed testing was completed using outdoor routes previously used by Mancil et al. (2005). The routes are 200 meters in length and incorporate one turn and one street crossing. Survey data were collected using two validated instruments designed for this population: Veterans Affairs Low-Vision Visual Functioning Questionnaire (VA-LV-VFQ) (Stelmack et al., 2006) and the Independent Mobility Questionnaire (IMQ) (Turano et al., 1999). The VA-LV-VFQ, according to Stelmack et al. (2006), "was designed to measure the difficulty visually impaired persons have in performing daily activities and to evaluate vision rehabilitation outcomes" (p. 3,253). The IMQ was created originally as a tool to measure independent mobility in patients with retinitis pigmentosa (Turano et al., 1999) and has since been validated for use with glaucomatous vision loss (Turano et al., 2002). Reading speed measures were obtained using MN Read text and the I-Scan eye movement monitoring system (ISCAN, Inc., Woburn, MA).

Those with HH were randomly assigned to receive either (a) lateral prism placement (i.e., traditional Fresnel press-on prism placement; see Figure 1) or (b) expansion prism placement (i.e., Peli's horizontal expansion prism lens placement; Peli, 2000; see Figure 2). After initial vision and mobility testing, HH participants were seen by a low-vision optometrist for prism fitting and instruction and underwent visual skills/visual scanning training using the prism device (based on Laderman et al., 2000, and Szlyk et al., 2005). They received mobility training that involved walking with the device and practice with obstacle detection while walking and using the device. Participants were assigned 1 week of home-practice indoor and outdoor mobility activities at the conclusion of the first visit. Each participant was contacted by phone within the first week to verify compliance with the prism device and mobility practice tasks.

Each HH participant was seen again from 7 to 14 days later, at which time visual skills/visual scanning training and additional mobility training while wearing the prisms were repeated, and each participant was again assigned 1 week of home-

practice exercises. One to two weeks later, each HH participant was seen for a final visit to obtain postintervention walking speed measurements, reading speed measurements, and postintervention surveys.

## Case Presentations

Participant 1 is a 49-year-old woman who experienced right HH after CVA 2 years previously. Her best corrected visual acuity was 20/20 in the right eye, 20/20 in the left eye. Her initial outdoor walking speed was 1.70 meters per second, and reading speed was 173.31 words per minute. She reported difficulty with 14 mobility-related activities of daily living addressed with IMQ. The greatest difficulty was identified as adjusting to lighting changes, both indoor to outdoor and outdoor to indoor. She was fitted with a Peli prism system and completed the three clinic visits and home training.

At her third visit, her outdoor walking speed measured 1.78 meters per second. Her reading speed measured 246.09 words per minute. Of the 14 areas of difficulty originally reported with IMQ, improvement was noted in 13 areas. At the conclusion of this visit she rated her mobility as very much improved and indicated that she will continue to use the prism device.

Participant 2 is a 58-year-old man who experienced left HH after CVA 3 years previously. His best corrected acuity was 20/30 in the right eye, 20/80 in the left eye. His initial outdoor walking speed was 1.27 meters per second, and reading speed measured 183.94 words per minute. Difficulty was reported with 26 mobility-related activities of daily living addressed with IMQ. The most significant areas of difficulty were walking in unfamiliar areas, seeing cars at intersections, avoiding bumping into knee-high objects, avoiding bumping into low-lying objects, stepping onto curbs, stepping off curbs, moving about in crowded situations, and moving about in stores. He was fitted with a Peli prism system and completed the three clinic visits and home training.

At his final visit, his outdoor walking speed measured 1.24 meters per second. His reading speed measured 195.05 words per minute. Of the 26 areas of difficulty reported with IMQ, improvement was noted in 23 areas. At the conclusion of this visit he rated his mobility as somewhat improved and

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**Figure 1.** *Traditional prism.*

indicated that he will continue to use the prism device.

Participant 3 is a 58-year-old man who experienced left HH after CVA 5 years previously. His best corrected acuity was 20/25 in the right eye, 20/20 in the left eye. His initial outdoor walking speed was 1.61 meters per second, and reading speed measured 133.95 words per minute. Difficulty was reported with 16 mobility-related activities of daily living addressed with IMQ. His areas of greatest difficulty were identified as walking in unfamiliar areas, moving about in crowded situations, walking at night, and avoiding bumping into people. He was fitted with a traditional prism system and completed the three clinic visits and home training.

At his final visit, his outdoor walking speed measured 1.62 meters per second. His reading speed measured 118.42 words per minute. Of the 16 areas of difficulty reported with IMQ, improvement was noted in 14 areas. At the conclusion of this visit he rated his mobility as somewhat improved and indicated that he will continue to use the prism device.

Participant 4 is a 47-year-old man who experienced right HH after CVA 10 years previously. His best corrected visual acuity was 20/20 in the right eye, 20/20 in the left eye. His outdoor walking speed was 1.76 meters per second, and reading speed measured 234.11 words per minute. With IMQ he reported difficulty with 18 mobility-related activities of daily living. Most significantly, he reported difficulty

when moving about in crowded situations, avoiding bumping into knee-high objects, and avoiding bumping into low-lying objects. He was fitted with a traditional prism system and completed the three clinic visits and home training.

At his final visit, his outdoor walking speed measured 1.62 meters per second. His reading speed measured 279.26 words per minute. Of the 18 areas of difficulty reported with the IMQ, improvement was noted in 15 areas. At the conclusion of this visit he rated his mobility as very much improved and indicated that he will continue to use the prism device.

Participant 5 is a 53-year-old male who experienced right HH after CVA 5 years previously. His best corrected visual acuity was 20/25 in the right eye, 20/20 in the left eye. His initial outdoor walking speed was 1.58 meters per second, and reading speed measured 70 words per minute. He reported difficulty with four mobility questions addressed with IMQ. The most significant area of difficulty identified was being aware of another person's presence. He was fitted with a traditional prism system and completed the three clinic visits and home training.

At his final visit, his outdoor walking speed measured 1.78 meters per second. His reading speed measured 117 words per minute. Of the four areas of difficulty reported with the IMQ, improvement was noted in one area. At the conclusion of this visit he rated his mobility as very much improved and indicated that he will continue to use the prism device.



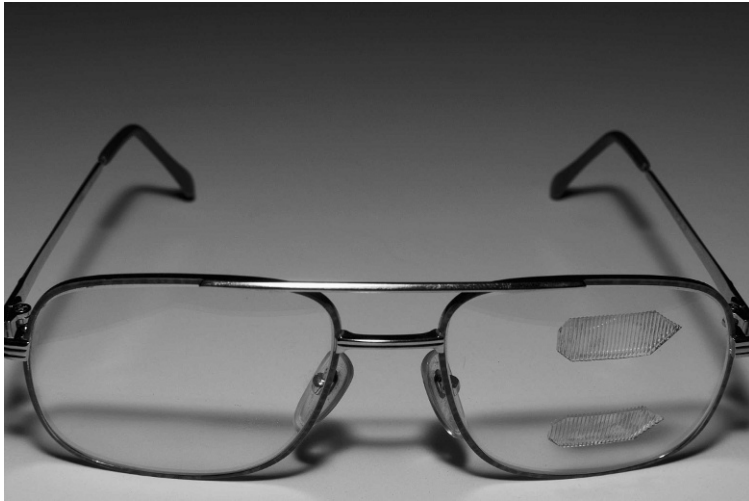


Figure 2. Peli prism.

## Discussion

The mean age of the HH participants ( $N = 5$ ) was 53 years. The mean age of the participants with normal sight ( $N = 12$ ) was 49.25 years. In this study, participants with normal sight walked outdoors at an average rate of 1.85 meters per second (standard deviation = 0.144) compared with HH participants' speed of 1.58 meters per second (standard deviation = 0.144) ( $p = .01$ ). After intervention, HH participants improved to 1.63 meters per second (standard deviation = 0.176) ( $p = .222$ ). Although four out of five HH participants walked faster after training, this improvement is not statistically significant (note the small sample size).

Participants with normal sight reported no difficulty with all 32 scored mobility questions addressed by the IMQ. The HH participants stated they had difficulty with 31 out of the 32 questions, reporting the highest levels of difficulty with (a) walking in unfamiliar areas; (b) moving about in crowded situations; (c) being aware of another person's presence; (d) avoiding bumping into people; (e) avoiding bumping into shoulder high objects; (f) avoiding bumping into knee high objects; and (g) avoiding bumping into low lying objects.

Participants with normal sight reported no difficulty with questions from the VFQ-48 survey.

The HH participants all reported difficulty in each of the five subject categories (i.e., visual ability, visual information, reading, visual motor, and mobility), with the largest disparity noted in the scoring of visual

information processing. After training, HH participants had scores that indicated less difficulty in each of the five categories, but they still reported having greater difficulty than normal participants. The HH patients reported their overall mobility to be either somewhat improved ( $N = 2$ ) or significantly improved ( $N = 3$ ). Each participant chose to continue to wear the prism device.

Mean reading speed for participants with normal sight was 226 words per minute (standard deviation = 36.4), significantly faster than the HH patients' 159 words per minute (standard deviation = 61.3) ( $p = .029$ ). After intervention, HH patients improved reading speed to 191 words per minute (standard deviation = 73.5) ( $p = .106$ ), but this improvement was not statistically significant (note the small sample size).

## Conclusion

Those with HH walk significantly slower than individuals with normal sight in the everyday environment. Based on survey measures, the interventions applied for HH led to improvement in perceived difficulty with mobility. Areas of greatest improvement were observed to be the following: walking in unfamiliar areas; moving about in crowded situations; being aware of another person's presence; avoiding bumping into people; and avoiding bumping into shoulder-high, knee-high, and low-lying objects. At the conclusion of the training visits, all HH participants reported their mobility to be improved, and each indicated he or she would continue to use the issued prism device.

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Based on our experience with these patients, we recommend that individuals with HH be evaluated with an optical prism combined with visual skills and mobility training. Participants responded positively to these interventions, and each perceived improved mobility at the study's conclusion. This pilot project was limited by the small sample size, despite efforts over several months to identify and enroll qualified participants. Although the cases reported and trends suggested have application to other individuals with HH, the small sample size did not provide for statistical significance with these findings. In order to obtain statistically significant results, any further study of mobility in this population will need to address difficulties related to transportation, confounding comorbidities, and previous use of prism. Furthermore, additional strategies may warrant investigation, including other approaches to fitting prisms, different types of prism systems, visual scanning training, orientation and mobility training, and combinations of these interventions. Additional evidence gathered from randomized and controlled trials would be of great value to patients with HH who, as shown in this project, face unique difficulties with mobility and independence.

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# Mediating and Moderating Effects on the Association between Vision Loss and Depression among an Older Population

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## Abstract

The purpose of this study was to gain a more holistic view of the association between depression and visual functioning by examining possible mediating and moderating factors. Previous research has established a linkage between low life satisfaction and coping skills and depressive symptoms. Results of this study contribute to this literature by indicating that life satisfaction partially mediates the relationship between visual functioning and depression. Furthermore, a significant coping by visual functioning interaction was discovered, revealing that among this sample, visual impairment is associated with higher levels of depression among individuals with low coping skills; however, little effect was found for individuals with high coping skills. Results provide support for the importance of early screening of satisfaction with life and coping among older individuals experiencing age-related visual impairment.

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Keywords: depression, vision loss, coping styles, low vision, life satisfaction

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## Introduction

Vision loss is generally recognized as a major health care problem among older people. Approximately one person in three has some form of vision-reducing eye disease by the age of 65, the most common causes being age-related macular degeneration, glaucoma, cataracts, and diabetic retinopathy (Quillen, 1999). Given that the average life expectancy in the United States continues to

increase, the risk of vision-reducing eye disease also is increasing, making age-related vision loss one of the most prevalent medical conditions among older people (Congdon et al., 2004). Not only does vision loss reduce a person's ability to perform activities of daily living, it also increases his or her chances of being affected by depression. Recent studies have found that older adults with visual impairment and depressive symptoms are particularly vulnerable to health decline and further disablement (Jones, Rovner, Crews, & Danielson, 2009). Of the different variables that have been postulated to mitigate depressive symptoms, life satisfaction and coping styles have been found to be

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particularly helpful (Klein, Turvey, & Pies, 2007; Swami et al., 2007). The purpose of this study is to further explore the potential positive impact of life satisfaction and coping styles on reducing the onset of depression among older adults affected by vision impairment.

Depression among older people has long been acknowledged as a prevalent and serious concern. Depression in older adults is associated with an increased risk of cancer, heart disease, stroke, dementia, and Parkinson's disease (National Center for Health Statistics, 2005). Recent studies have broadened understanding in this area by examining the effects of depressive symptoms among older adults with vision loss, another prevalent and debilitating condition. Jones and colleagues (2009) found that older, visually impaired adults with depressive symptoms are particularly vulnerable to physical and mental decline without timely interventions. Specifically they found that this population was more likely to be current smokers, obese, and physically inactive and to rate their health as worse than nondepressed older adults with visual impairments. Because vision impairment and depression are often comorbid, it is important to examine potential factors that may be influencing the association between these two conditions. Of the different variables that have been examined as mitigators of depressive symptoms, life satisfaction and coping styles have been found to be particularly helpful.

A number of studies have found that life satisfaction, which has been described as subjective well-being and "the personal ability to enjoy oneself and one's own life" (Koivumaa-Honkanen et al., 2001), has a strong negative correlation with depression (Koivumaa-Honkanen, Kaprio, Honkanen, Viinamaki, & Koskenvuo, 2004). This association has been found among adolescents (Hawkins, Hawkins, & Seeley, 1992) and adults (Parkerson, Broadhead, & Tse, 1990), as well as psychiatric patients (Koivumaa-Honkanen et al., 2001). In a study examining the health status of first-year medical students, a population at high risk for depression, researchers found that students who reported high life satisfaction had fewer symptoms of depression and anxiety as well as higher self-esteem, better physical, mental, and social health than students reporting low life-satisfaction (Parker-son et al., 1990).

Life satisfaction has also been shown to be predictive of depression. For example, in a 15-year prospective study of healthy Finnish adults, researchers found that not only was self-reported life satisfaction strongly associated with depressive symptoms, but it was also strongly predictive of subsequent depressive symptoms. Although life satisfaction is strongly affected in depression, research has found that it does improve concurrently with recovery from depression (Koivumaa-Honkanen et al., 2001). A more recent study found similar findings, in that fewer depressive symptoms and greater satisfaction with participation in social roles explained better quality of life in a Canadian sample of older adults with visual impairment (Renaud et al., 2010).

Because life satisfaction and depression are commonly associated, it is reasonable to assume that vision impairment, a condition that is frequently comorbid with depression, would also influence this relationship. Furthermore, the many challenges older individuals face when they experience vision loss, as previously noted, would likely contribute to a decrease in life satisfaction. Therefore, it is logical to assume that part of the effect of visual impairment on depression may be a result of decreased satisfaction with life.

A number of recent studies have begun to highlight the important role of life satisfaction among older adults who are visually impaired. For example, individuals with visual impairment have been found to report significantly lower levels of life satisfaction compared with their non-visually impaired peers (Good, 2008). Similarly, a recent study by Brown and Barrett (2011) examined four potential mediators of the association between life satisfaction and visual functioning in a nationally representative sample of older persons. Results from their regression analyses indicated that each of the hypothesized mediators—activity limitations, socioeconomic resources, social resources, and psychological resources—mediated the relationship between life satisfaction and visual functioning. Specifically, psychological resources (measured by self-efficacy) had the strongest mediating effects, such that visually impaired individuals with higher self-efficacy reported higher rates of life-satisfaction compared with individuals reporting lower levels of self-efficacy. Whereas previous research has focused on the main direct effects of life satisfaction

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on depression, this study examines the mediating effects of life satisfaction.

Another variable that has been examined for its relationship to depression is coping styles, which have been conceptualized as the specific ways in which individuals respond to internal or external demands they deem stressful (Lazarus & Folkman, 1984). Coping is generally divided into either problem-focused coping, in which the individual attempts to directly influence the stress, or emotion-focused coping, which involves managing the negative affect of the situation (Lazarus & Folkman, 1984). Moreover, these coping styles can be further broken down into either adaptive or maladaptive strategies. Studies have found that maladaptive coping strategies such as denial, distraction, and avoidance not only hinder recovery from sickness but may actually increase the risk of mortality (Doering et al., 2004; Murberg & Bru, 2001). In a recent study, Klein et al. (2007) revealed that maladaptive coping styles such as self-denial, self-distraction, and self-blame were associated with more depressive symptoms among older adults experiencing heart failure.

This study attempts to extend this research by proposing that the relationship between visual functioning and depression is influenced by a third variable—coping. Research has clearly demonstrated the transforming effects that coping style can have on the depressive symptoms of patients, and it is reasonable to assume that a similar pattern would be found among individuals experiencing visual impairment.

Previous research clearly indicates that both vision impairment and depression can individually have debilitating consequences and that having both conditions poses even greater challenges. Given the fact that these conditions are often comorbid, relatively little research has explored the interactive association between visual impairment and depressive symptoms and the factors that may be influencing this association. Whereas previous studies have used simple bivariate associations to examine the relationship between these variables, this study attempts to take a more holistic view of the associations among vision loss, depression, life satisfaction, and coping styles. Specifically, the first hypothesis is simply that visual functioning is negatively associated with depression. Second, it is hypothesized that satisfaction with life is also

negatively associated with depression. The third hypothesis is that life satisfaction will mediate the relationship between vision impairment and depression by transforming the nature of the relationship such that individuals experiencing vision impairment will experience relatively lower levels of depression when they report high life satisfaction. Last, it is also proposed that coping will have a moderating influence on the association between visual functioning and depression.

## Methods

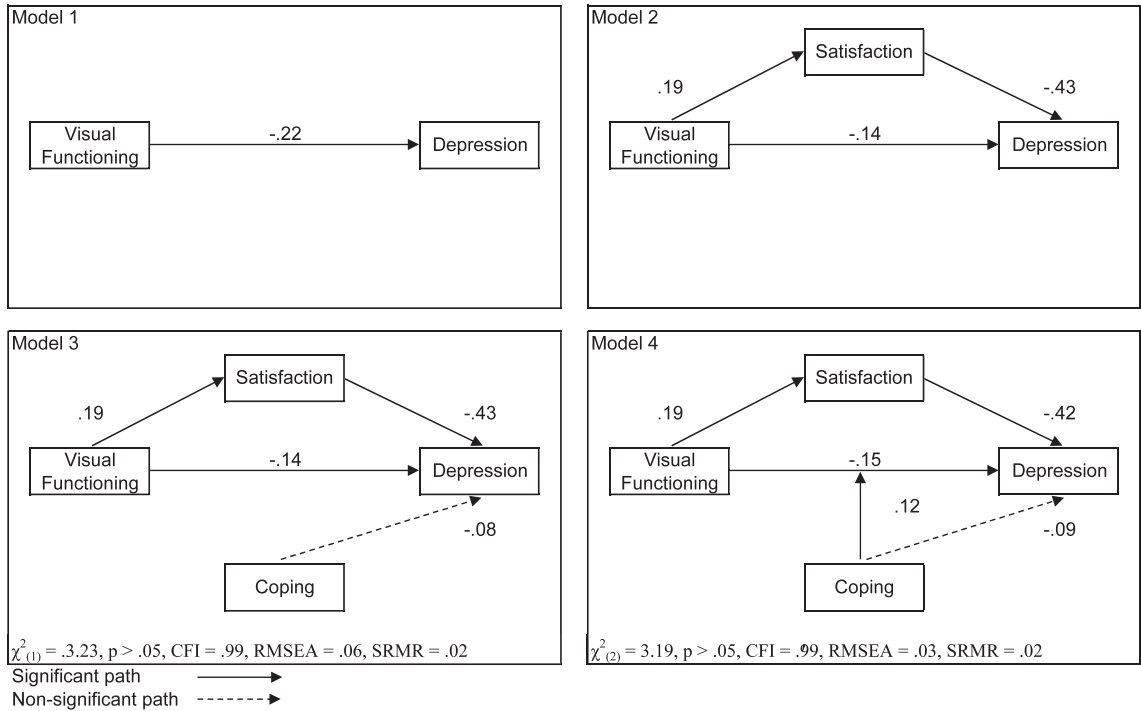
### Study Population

Participants were recruited at three McGill University–affiliated hospitals (Jewish General Hospital, Montreal General Hospital, and Royal Victoria Hospital) and one University of Montreal–affiliated hospital (Hôpital Notre Dame) in Montreal, QC, Canada. Recruitment began January 15, 2007, and is ongoing. However, for the purpose of the presented results the database was accessed on December 14, 2009, at which time a total of 623 participants had been recruited (91.48 percent of approached individuals agreed to participate). Participants ranged in age from 26 to 100 years, with the majority of participants being over the age of 60 years (mean = 74.52 years, standard deviation = 13.31 years). Approximately 44 percent of the participants were men and 56 percent were women. Eligible participants were identified through daily chart reviews within the ophthalmology departments the day before patients would arrive at the clinic. Based on visual acuity, those who qualified for free vision rehabilitation services within the province of Quebec (visual acuity of 20/70 or less in the better eye with best standard correction) were approached the following day in the waiting room by a research assistant and informed about the possibility to participate in a survey while awaiting their eye care professional.

### Data Collection

The medical chart of each patient was obtained to collect best-corrected visual acuity in the better eye, visual field defects, and ocular diagnoses. The visual functioning measure (VF-14; Linder et al., 1999) had a Cronbach's alpha of .94. Participants were also asked a series of interviewer-administered questions. The Center for Epidemiologic Studies–Depression Scale (CES-D; Dreer, Elliot, Fletcher, & Swanson,

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**Figure 1.** The mediating and moderating effects of satisfaction with life and coping.

2005) 10-item short form was given to assess depression. This instrument has shown excellent sensitivity and specificity in older adults and has a Cronbach's alpha of .79. Scores range from 0 to 30, with higher scores indicating greater depressive symptoms. Scores of 10 have been used to indicate depression. The Brief COPE (Carver, 1997; Cooper, Katona, & Livingstone, 2008), a 28-item questionnaire, determines the frequency with which people engage in different coping mechanisms. There are 14 subscales, one for each coping mechanism, and scores on each subscale range from 0 (*never use*) to 8 (*use most of the time*). This measure has a Cronbach's alpha of .74. The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin,

1985) is a short five-item questionnaire that has been shown to have excellent reliability in past studies (Burr, Santo, & Pushkar, 2009; Diener, Suh, Lucas, & Smith, 1999), with a Cronbach's alpha of .79 in the current sample. An interview was performed to collect information on demographics, general health status, and visual problems.

## Results

In order to test the proposed hypotheses, structural equation modeling with M-Plus (Muthén & Muthén, 2006) was used to test four separate models (see Figure 1). Means and standard deviations were calculated for the study variables and are presented in Table 1 along with the zero-order

**Table 1.** Zero-Order Correlations and Descriptive Statistics

Models	1	2	3	4	Mean	SD
1. Visual Functioning (mean)	–				38.56	24.61
2. Brief COPE (total)	–.07	–			71.30	15.29
3. CES-D (total) <sup>a</sup>	–.22**	–.09*	–		7.75	5.97
4. Satisfaction with Life	.19**	.07	–.46**	–	5.01	1.30

<sup>a</sup> CES-D = Center for Epidemiologic Studies–Depression Scale.

\*  $p < .05$ , \*\*  $p < .01$ .

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correlations. In the first model, depression was regressed on visual function. Results indicated that visual functioning significantly predicted depression ( $\beta = -.22$ ,  $b = -.05$ , standard error [SE] = .04,  $z = -5.58$ ,  $p < .05$ ) and explained 4.90 percent of the variability in depression.

In the second model, depression was again regressed on visual functioning and satisfaction with life was examined as a possible mediator. Visual functioning ( $\beta = -.14$ ,  $b = -.03$ , SE = .04,  $z = -3.73$ ,  $p < .05$ ) and satisfaction with life ( $\beta = -.43$ ,  $b = -1.97$ , SE = .03,  $z = -12.70$ ,  $p < .05$ ) both significantly predict depression, accounting for 22.70 percent of the variability in depression. Vision functioning significantly predicted satisfaction with life as well ( $\beta = .19$ ,  $b = .01$ , SE = .04,  $z = 4.74$ ,  $p < .05$ ), accounting for 3.6 percent of the variance. A test for indirect effects revealed that the effect of visual functioning was partially mediated by satisfaction with life ( $p < .05$ ). In other words, 32.00 percent of the effect of vision loss on depression can be accounted for by the subsequent reduction in life satisfaction that occurs when visual functioning declines.

In the third model, coping style was examined as a potential moderator of the relationship between vision loss and depression. Once again, visual functioning ( $\beta = -.14$ ,  $b = -.04$ , SE = .04,  $z = -3.88$ ,  $p < .05$ ) and satisfaction with life ( $\beta = -.43$ ,  $b = -1.95$ , SE = .03,  $z = -12.48$ ,  $p < .05$ ) significantly predicted depression. Coping style, however, did not have a significant main effect on depression ( $\beta = -.08$ ,  $b = -.03$ , SE = .02,  $z = -1.84$ ,  $p > .05$ ). In fact, the addition of coping style only explained an additional .20 percent of the variability in depression. Visual functioning remained a significant predictor of satisfaction with life ( $\beta = .19$ ,  $b = .01$ , SE = .04,  $z = 4.74$ ,  $p < .05$ ), accounting for 3.60 percent of the variability in life satisfaction. Notably, results indicated that this model was a good fit to the data ( $\chi^2_{(1)} = 3.23$ ,  $p > .05$ , CFI = .99, root mean square error of approximation [RMSEA] = .06, standardized root mean square residual [SRMR] = .02).

Finally, in the fourth model, visual functioning ( $\beta = -.15$ ,  $b = -.04$ , SE = .04,  $z = -4.01$ ,  $p < .05$ ), coping style ( $\beta = -.09$ ,  $b = -.03$ , SE = .04,  $z = -2.07$ ,  $p < .05$ ), visual functioning-by-coping interaction ( $\beta = .12$ ,  $b = .74$ , SE = .04,  $z = 2.93$ ,  $p < .05$ ), and satisfaction with life ( $\beta = -.42$ ,

$b = -1.94$ , SE = .03,  $z = -12.49$ ,  $p < .05$ ) significantly predicted depression. As can be seen in Figure 2, the visual functioning-by-coping interaction indicates that among this subsample, changes in visual functioning had little effect on depression among individuals with high coping skills. However, individuals with low coping skills and low visual functioning tended to experience a greater number of depressive symptoms than their counterparts with high visual functioning. Overall, the total set of predictor variables explained 24.40 percent of the variability in depression. Visual functioning was also significantly predictive of satisfaction with life ( $\beta = .19$ ,  $b = .01$ , SE = .04,  $z = 4.73$ ,  $p < .05$ ), indicating that poor visual functioning is associated with lower life satisfaction. Visual functioning accounted for 3.60 percent of the variability in satisfaction with life. Like the previous model, statistics indicated that this model was also a good fit to the data ( $\chi^2_{(2)} = 3.19$ ,  $p > .05$ , CFI = .99, RMSEA = .03, SRMR = .02).

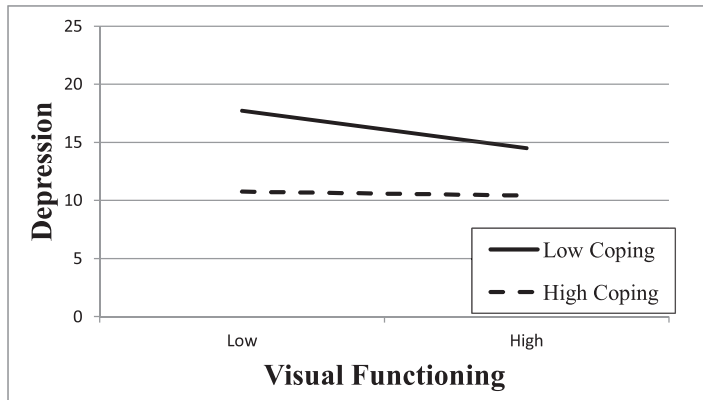
## Discussion

The primary objective of this study was to integrate the existing literature on visual impairment and depression and to examine the mediating and moderating role that life satisfaction and coping have on this relationship. The results of the analyses confirm the original predictions that life satisfaction would mediate the relationship between visual functioning and depression and that coping style would moderate it. Although the data revealed that there was no main effect of coping, there was a significant interaction between visual functioning and coping, providing important information about the role that life satisfaction and coping can play when an individual is faced with declining visual functioning. This study provides valuable knowledge for clinical practitioners as well as anyone who is affected by visual impairment. Furthermore, as the knowledge base on comorbid visual impairment and depression continues to grow, so does our understanding of these debilitating conditions.

It was hypothesized that both visual functioning and life satisfaction would be negatively associated with depression. The results of the first two models indicate that visual functioning has a direct effect on depression, as well as an indirect effect, through life satisfaction. The fact that part of the effect of visual



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**Figure 2.** Interaction between visual functioning and coping.

functioning on depression can be explained by satisfaction with life indicates that among this population, low life satisfaction may be an early indicator of depression. Administering a life satisfaction measure to patients experiencing vision impairment may help with early detection of depression. Moreover, because life dissatisfaction is oftentimes an indicator of additional problems in an individual's life, assessment of life satisfaction in clinical practice offers many benefits. Beyond the role of screening, efforts to improve the subjective well-being of individuals affected by visual impairment may reduce or guard against current and future depressive symptoms.

Regarding the role of coping, the results confirmed the prediction that coping style would moderate the relationship between visual functioning and depression. Despite the significant visual functioning-by-coping interaction, there was no main effect of coping. In fact, when coping was added to the third model, it added less than .20 percent to the explained variance. This finding should be carefully interpreted, however, because this study used a mean coping score rather than specifying emotion versus problem-focused styles. Splitting the interaction into high versus low coping, it is evident that the effect of visual functioning on depression is not the same for everyone. Among this subgroup, changes in visual functioning had little effect on depression among the high coping group. Individuals with low coping, however, tended to experience more depressive symptoms when visual functioning was low. It is interesting to note that the specific coping items that participants rated most highly (with

average scores above 3.90 out of a possible 4) included "I've been thinking hard about what steps to take" and "I've been learning to live with it."

These findings suggest that high coping skills may buffer some of the effects of vision loss on depression, which is consistent with the current literature on coping and other medical illnesses. Given that coping is a learned skill, these results are encouraging. Emphasizing the protective benefits of effective coping and helping persons affected by visual impairment to adopt and employ these strategies is clearly beneficial. A limitation of this study is the relatively broad measure of coping. Future research could obtain a more sensitive analysis by separating coping into multiple variables such as emotion focused versus problem focused.

Future research would also benefit by obtaining further background information regarding additional factors in the participants' lives that may be necessitating the use of these coping strategies. Because coping strategies are learned responses to a situation, taking into account factors other than vision loss, such as social support, financial need, and marital status, would provide a more robust image of this relationship.

As the rate of visual impairment in North America continues to rise, interventions aimed at preventing or reducing the onset of comorbid depression are crucial. Given the serious nature and exacerbating effect that depression can have on individuals experiencing visual impairment, it is essential that those at high risk for comorbid depression and visual impairment be identified as early as possible. The mediating and moderating effects of life satisfaction

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and coping skills may provide clinical practitioners with an indicator of individuals at high risk. If taken into account, the mitigating effect of these factors will likely improve the quality of life of individuals experiencing visual impairment.

## Acknowledgments

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# Dog Guides and Deaf-Blindness: The Deaf-Blind Component of the Special Needs Program at Guiding Eyes for the Blind

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## Abstract

Many people who are deaf-blind may benefit from the enhanced opportunities for travel that a dog guide offers. Since its inception in the 1950s, Guiding Eyes for the Blind has successfully trained nearly forty clients who are deaf-blind as dog guide users. Today, more than a third of the current applicants to Guiding Eyes' Special Needs Program have deaf-blindness. This paper is a brief description of the deaf-blind component within Guiding Eyes for the Blind Special Needs Department, including descriptions of acceptance criteria, the training process, and a brief account of staff and graduates.

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Keywords: deaf-blindness, dog guides, orientation and mobility, training

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## Background

When the legendary dog guide instructor Ted Zubrycki was thinking "outside of the box" while working for Guiding Eyes for the Blind (GEB) almost 40 years ago, he reasoned that if there was a chance for a traveler to be a successful dog guide user, Guiding Eyes would make every effort to make it happen.

With Ted's lead, GEB began training its first deaf-blind client in the late 1970s. In the 1980s, he trained four more clients, with great success. In 1990, the Special Needs Department at GEB was established. In 2010, there were fourteen deaf-blind applicants on the waiting list of thirty-six people; more than a third of Special Needs applicants have deaf-blindness. Of

61 active Special Needs graduates, eighteen (30 percent) of them have deaf-blindness.

There are four staff members in the program: three full time instructors and Director Ellin Purcell, who has worked at Guiding Eyes for 22 years. The GEB Director of Training, Kathy Zubrycki, works closely with the Special Needs Department. The instructors in the Special Needs Program are all at the intermediate skill level or above in American Sign Language (ASL).

## Admissions Process

There are several steps in the admissions process for a dog guide candidate. An applicant will first be screened by phone or e-mail to determine if he or she is a possible candidate for a dog guide. If the person passes the initial screening, he will be interviewed in his home by a field representative or another staff member of the Training Department.

The home interview yields important information that will determine how to best address and meet the

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student's needs. This interview sets the stage for cooperative goal setting while also providing the individual with realistic expectations and an understanding of caring for and utilizing a dog guide. Questions asked during the home interview include: cause of blindness; current visual fields and acuity; amount of useable travel vision; amount of time living with current amount of vision; previous orientation and mobility training; current travel skills; speed of travel; living and work environment; travel needs and preferences; and future travel goals. Questions about the dog are concerned with animal understanding, realistic understanding of dog guide mobility, and strength of pull necessary to accurately guide the individual.

### Considerations for the Deaf-Blind Applicant

When working with a deaf-blind applicant, it is crucial to fully understand their receptive and expressive communication skills, abilities, and needs. They may receive communication aurally via hearing aid(s) and/or cochlear implant(s); use speech/lip reading; use ASL and/or finger spelling visually or tactually, with one or two hands; or a combination of all. Expressive communication may be verbal, signed, written, or a combination of all. Receptive communication will directly impact how the *individual* is trained; expressive communication will impact the individual's *and* the dog's training. For example, some students may use the tone and volume in their voice to express joy, disapproval, praise, or correction to the dog. If the individual does not use verbal communication, these concepts can be conveyed to the dog in non-verbal ways. Information from the interview will directly impact the dog's selection and training prior to placement with the deaf-blind individual.

### Training

Training a person with deaf-blindness to use a dog guide requires a one-to-one or one-to-two instructor-student ratio, specifically chosen dog guides, and extra time for communication and repetition of skills. The training is intensive and includes teaching techniques for holding the harness handle while following the dog's movements, controlling the traveler's body position while walking, maintaining proper following

position, using specific movements to give commands to the dog, and maintaining a communication flow between the trainer and the student.

Assessing a deaf-blind individual's orientation and mobility skills is similar to assessing a blind applicant's skill. The level of mobility services specifically addressing the needs of a deaf-blind traveler vary greatly from state to state. It is not uncommon for an individual to have received original services from an agency that has not previously worked with deaf-blind clients. The skill level of these clients can differ greatly from the skill level of clients who have attended a program at an organization such as the Helen Keller National Center, where skills specific to deaf-blind travelers are taught.

Individual strategies are considered. For example, the home interview with a deaf-blind traveler specifically addresses street crossing skills. Does the individual properly use communication cards (laminated paper with pictures and typewritten sentences for various activities) for crossing streets? Does the individual use remaining vision to scan? Acceptance for training with a dog guide is dependent on already established safe street crossing skills, but GEB will work with an individual to improve/enhance current skills, particularly in the proper use of communication cards designed by the Helen Keller National Center.

### Training Options

Two training options are available for successful deaf-blind applicants to the Special Needs Program: Class Training and Home Training.

Class Training, which covers 26 days for a new student, allows for complete immersion in learning the skills of traveling with a dog guide. While the actual mobility lesson lasts a few hours each day, the client and instructor work together for 14 to 16 hours daily, from 6 a.m. to 8 p.m. Coursework includes learning about caring for the dog, handling the dog during routine daily activities, and discussion of theory.

Class training is beneficial for consistent, focused, supervised handling. It allows for the individual to interact with fellow dog guide handlers. Exposure to other individuals in training—both new students and individuals receiving successor dogs—provides peer support, which often has a great impact and validates lessons.

The GEB dormitory is equipped with fire alarms, doorbells, and telephone signalers that are all

## Dog Guides and Deaf-Blindness

vibrotactile. There is a braille TTY and a large visual display TTY, as well as two Screen Braille Communicators (SBCs). An SBC is a portable unit with a QWERTY keyboard and LCD display on one side, and a braille keyboard and braille display on the other that can be used by a person who is deaf-blind to communicate with non-signers.

Computers have ZoomText and refreshable braille displays. The instructors facilitate communication when possible, while the SBC allows deaf-blind clients to communicate directly with other clients in training, or other staff members who do not know ASL.

Home Training works better for individuals who function best in their own environment with their current support systems in place. It also allows for training students on their own routes, in their own environment. Home Training for new students is a minimum of 15 days. The work day is flexible, built around the student's schedule. Some lessons occur to, from, or at a student's place of employment. Other lessons might incorporate recreational or familial places. The object here is to help the dog guide team adjust as quickly and efficiently as possible into the real world where it will be experiencing most of its travels.

If it is decided by the department personnel that class training is best, all new deaf-blind students receive 3 weeks of class training, with the last week of training in the individual's home area.

To be accepted in the program the applicant must already have good orientation and mobility skills. In working with a dog guide, the training shifts to applying these skills to safe travel with the dog guide as well as to learning deaf-blind specific traveling techniques. For example, if communication cards will be used, the correct method for using the cards in various situations will be practiced, along with the protocol to be followed with the dog guide.

Certified interpreters may be hired to facilitate communication with students who use ASL as their primary language. Interpreters may also be hired for evening lectures, as well as for other class events.

## Conclusion

The Special Needs Department at GEB trains dog guides to work with people who have physical challenges in addition to blindness, including deaf-blindness. More than a third of Special Needs applicants have deaf-blindness. In 2010, on a waiting list of 36 applicants, more than a third (14) were deaf-blind. Of 61 active Special Needs graduates, 30 percent (18) have deaf-blindness. The past and current success of dog guides with deaf-blind graduates continues to serve as an inspiration for the department, the school, and for the entire community.

# Hemianopsia and Falls Prevention

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## Abstract

Vision plays a critical role in helping to maintain a sense of balance which is important in falls prevention. Any form of vision impairment including reduced visual field can heighten the risk of falls. This article outlines an interdisciplinary approach to the care of patients with hemianopsia. The article will provide vision rehabilitation professionals with a better understanding of prescribing prism systems, orientation and mobility training, and low vision rehabilitation techniques. In order to provide optimal services, an interdisciplinary approach to the care of patients with hemianopsia is essential in the success of low vision rehabilitation in falls prevention. The information contained in this article will focus on low vision services provided to adults with hemianopic visual field loss. Services at the Portland VA Medical Center Advanced Ambulatory Low Vision Clinic are provided by a low vision optometrist, certified low vision therapist, and orientation and mobility specialist. Others on the rehabilitation team include occupational, physical, speech, and kinesiotherapists. In other settings and with other populations, vision rehabilitation may be provided by trained professionals.

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Keywords: prisms, visual field enhancement, visual field expansion, orientation and mobility, low vision rehabilitation

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## Introduction

Hemianopsia is a term that describes a loss of vision that affects half of the visual field of one or both eyes. This field reduction prevents the individual from seeing objects in half of the visual field. Any conditions or injuries affecting the visual field

pathway may cause hemianopsia. These include stroke, brain aneurism, brain tumors, or traumatic brain injury. Occasionally people with migraines, extremely high blood pressure, or in conjunction with a seizure may also experience a transient form of hemianopsia. Other rare causes of the condition include infections such as encephalitis, brain abscesses, and Creutzfeldt-Jakob disease (Padula & Argyris, 2010).

Following the neurological event, individuals frequently lose their ambient or peripheral visual

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process and are left with a focal processing system that breaks up the visual world into isolated parts. This causes extreme difficulty with balance and movement. Another consequence of the incident is a tendency to compress and limit their spatial world.

Movement in a crowded environment becomes quite disturbing because the ambient or peripheral visual process is supposed to assist in stabilizing the image of the peripheral retina. Without this system the person internalizes the movement that he or she is experiencing in the peripheral vision. Disorientation and vertigo often persist and cause severe dysfunction, including falls (Padula & Argyris, 2010).

According to information from the Centers for Disease Control (Leukenotte & Conley, 2009), it has been estimated that the total direct cost of all fall injuries for people 65 and older in 2000 was more than \$19 billion: \$19 billion for nonfatal falls and \$179 million for fatal falls. By 2020, the annual direct and indirect cost of fall injuries is expected to reach \$43 billion (in current dollars) (Leukenotte & Conley, 2009). It is also reported that visual impairment is one factor for increase risk of falls in the elderly (Ramrattan et al., 2001). Because of this fact, intervention to prevent falls makes sense in cost savings in addition to contributing to the individual's well-being.

In the following sections, we will discuss types of visual field enhancement systems, and visual field expansion systems. Also discussed will be therapeutic techniques for training to be used by the low vision specialist.

## Visual Field Enhancement

One approach to dealing with hemianopic visual field loss is the use of a field enhancement prism. There are subtle differences between the two systems. Visual Field Enhancement utilizes techniques to enhance the use of remaining functional vision, whereas Visual Field Expansion actually expands the visual fields using prisms.

Bell (1949) was one of the earliest writers to reference visual field enhancement for a patient with hemianopsia. A mirror mounted to a patient's frame reflects the image of an object on the nonseeing side to the functioning area of the retina. The mirror system is not widely used today as it has many disadvantages, such as producing a nasal scotoma, creating a reversed image, and involving tedious and time-consuming training (Brilliant, 1999).

Today, a prism system is more widely prescribed and accepted by patients with hemianopsia. A prism system is prescribed to move the image of an object in the patient's non-seeing area to the seeing area ( $1\Delta = 0.57$  degree displacement).

The most commonly prescribed prism systems for visual field enhancement are sector and round prisms. A sector prism is a straight edged segment prism and a round prism is a round segment prism, 18 mm (3/4; inch) in diameter. The round prism was popularized by Gottlieb as the Rekindle™ System.

The type of ground-in prism (round vs. sector) prescribed will depend on the size of the patient's frame and the placement of the prism. Typically, a round prism is prescribed unilaterally on the temporal side of the lens as the nasal segment placement in the opposite lens may not meet the clearance criteria. In addition, prescribing a round prism in both lenses may induce diplopia when the patient is looking through both prisms. Patients with bilateral sector prisms may also experience diplopia therefore it may be necessary to prescribe the prism unilaterally. This will be determined during a trial period with Fresnel press-on prisms.

Normally, Fresnel press-on prisms (available in 0.5 to 30 $\Delta$ ) are prescribed and tried first to determine the effectiveness before ordering ground-in prisms in the spectacle which provide a clearer view of their missing field. This temporary prism usually needs to be replaced every 3 months.

Most practitioners start with a 15-prism diopter Fresnel press-on prism and increase the prism power (20 to 30 $\Delta$ ) depending on the patient's response to prism (Brilliant, 1999). Often, Fresnel press-on prisms are initially used because they are inexpensive and allow for the flexibility to add or subtract prism power to spectacles, cutting back on the prisms as necessary to adjust to a patient's comfort level during training. Fresnel press-on prisms often offer a good beginning point where a person can see if they even like the idea of using prisms or not.

A yoked prism system—a pair of identically powered and same direction full-field prisms—is also prescribed for visual field enhancement. The prism base is always oriented towards the visual field defect, requiring only a 4-diopter prism in each eye. The yoked prism works best for patients with homonymous hemianopsia and visual midline shift syndrome. The yoked prism is beneficial in that it



shifts the image to the seeing area and realigns the patient's perceived midline of space to the patient's actual anatomic midline (Brilliant, 1999). In some instances however, the patient may adapt to the prism, making it ineffective.

In general, patients with better acuity, including macular sparing, benefit most from field enhancement. This factor works well for those with hemianopsia as their visual acuity is often very good but there is field loss. Additionally, patients with the poorest travel skills often notice the greatest improvement when using a prism system (Perez & Jose, 2003).

From our experience, it is essential that the low vision optometrist is provided with input from other rehabilitation professionals involved in the patient's care. Vision-related professionals, such as the low vision therapist and orientation and mobility specialist, are particularly responsible for providing input on functional use of the prism adaptations. Through constant communication, the low-vision optometrist may recommend modifications, such as cutting back on the Fresnel prisms, recommending that a different type of prism is tried, or discontinuing training altogether.

Some practitioners will modify the placement of the Fresnel press-on prism as the patient learns to scan more efficiently into the affected side of the visual field. The prism is gradually moved further away from the visual axis (center of the pupil) toward the affected visual field area. Some practitioners feel that the prisms aid the patient's scanning ability to a point where the prisms are no longer needed.

## Visual Field Expansion

Another approach to falls prevention is to expand the visual field. Eli Peli from Schepens Eye Research Institute originated the concept of Expansion Prism (EP) lens. Peli (2000) described a novel prismatic device to expand the visual fields of patients with homonymous visual field defects. He prescribed high-power Fresnel press-on prism segments ( $40\Delta$ ) across the whole width of the spectacle lens above and below, which simultaneously expanded 20 degrees of horizontal visual field in the upper and lower peripheral visual fields. These prism segments are usually prescribed in one lens on the side of the visual field loss. This field expansion device may also be prescribed in the upper segment of the lens only, allowing bifocal utilization. A

multicenter community-based research project found significant benefits of the peripheral prism glasses for obstacle avoidance in a variety of mobility situations (Bowers, Keeney, & Peli, 2008).

The visual field expansion concept was further developed by Chadwick Optical, Inc. In this design, the permanent rigid form of the Fresnel prism segment is embedded in a plastic spectacle lens (Bowers et al., 2008). A starter kit for fitting the EP lens may be purchased. This kit includes precut temporary Fresnel press-on prisms ( $40\Delta$ ) in a set of two, or four sets of two ( $8 \times 22$  mm). An EP-Horizontal Screening Device is also available. It is critical to select an adequate frame size to meet the fitting criteria. An optimal separation between upper and lower prisms is 12 mm and the carrier lens must have clearance of 3 mm or greater to the edge of the lens. A permanent EP lens may also be ordered once a patient is successful with the temporary EP lens.

## Vision Rehabilitation Training Techniques

Developing efficient scanning technique is one of the key areas of training. Frequently, those with hemianopsia exhibit deficits in search saccades, fixation, and scan paths (a series of saccades and fixations used when viewing a structured scene). The person is also more likely to dwell on the intact hemi field and their saccades are less regular, less accurate and too small to allow rapid, organized scanning or reading. Because of this, relevant parts of the environment are missed. Therapy to assist with these difficulties includes training of saccadic movements, fixation, and organized scanning methods.

Most frequently, rehabilitation incorporates improving the awareness of the visual field loss and using visual search strategies to encourage the individual to scan into the impaired side. Search strategies include increasing head movements and fast eye scanning movements to the impaired side (Rowe, 2008).

Therapeutic intervention as outlined by Scheiman, Scheiman, and Whittaker (2007) includes a three-step sequence. Initially, the patient is engaged in various search tasks. One technique described forces fixation to the side of inattention by smearing Vaseline or taping one half of each lens on the intact side with

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translucent tape. This forces the patient to look past the midline in the direction of the visual field loss. Another method for field attention developed by Dr. Sarah Appel involves placing a colored filter on one half of each lens or cutting the lenses of inexpensive sunglasses. When the patient looks in the direction of the field loss he or she will see the color change.

Step two involves having the patient scan a room to find unexpected objects. For example, the person may be asked to find hazards in an area or pick up objects from the floor. Systematic scanning methods may be taught during these sessions.

Step three establishes the warning function of the peripheral retina. In this step, objects approach from the affected side during activities of divided attention. One such activity described is “squares” (<http://www.superkids.com/aweb/tools/logic/dots/>), which is a free game found on the web. The goal of this game is to establish the habit of quickly and frequently looking into the area of the affected field. Another activity described is “laser tag.” The therapist and the patient each hold a laser pointer. The therapist presents the laser spot on the wall and the patient is expected to tag the spot with his laser pointer. This task is graded from two predictable points, and then increased by moving the light beam to an unpredictable position, or a more cluttered area.

According to information from *Functional Evaluation & Training Techniques in the Use of Fresnel Prisms for Individuals with Restricted Visual Fields* by Audrey Smith and Duane Geruschat (2009), training begins in static indoor environments. Instruction later occurs in more dynamic and complex situations, eventually moving to busy outdoor environments, depending on the patient’s situation and goals.

When beginning training, patients often are not aware of the hemianopsia (anosognosia) or even completely deny their hemi-neglect (Huber, 2000). If a person does not realize that they have a portion of their visual field missing, safe travel will most definitely be impaired. Once prisms are trialed, it is not uncommon for patients to comment on how the prisms have helped them to realize how much vision they were previously missing from their field loss. Even without the use of prisms, scanning can be improved. However, prisms often provide a much-needed enhancement when training someone to improve scanning and to have a better awareness of their missing visual field.

For some people, training on the use of a long cane can be helpful in both detecting objects and

people in their missing field. In addition, long canes communicate to others that the cane user has a vision impairment. It should be noted that the orientation and mobility specialist needs to check the cane laws in the state that the patient lives in, and the patient should be educated that some states, such as Oregon and California, do not allow one to use a long cane unless the cane user is legally blind. For people with hemianopsia, the purpose of a long cane is simply to detect hazards in the part of the person’s missing visual field. Therefore, in the majority of the cases a diagonal technique is preferable. Some people even prefer to keep the cane tip off of the ground if they are not worried about drop-offs and changes in elevation. It is very common that people find the cane to be the most useful during orientation and mobility training. Then, after they improve their scanning techniques and become more comfortable with travel, they may prefer to stop using the cane or use it on a less frequent basis. Of course, this varies from person to person.

Rowe (2008) describes visual restorative therapy as a technique that includes flicker stimulation of the blind field, which produces changes in the cortical function with supposed cortical reorganization. She points out that improvement has been noted in locating moving flickering objects in the blind field, and improving navigation skills, reading ability, and visual sensitivity. Even so, this technique is controversial in that although some expansion of the visual field loss has been reported, none of the treatment options have shown permanent amelioration of the visual field loss.

As with any therapeutic intervention, it is essential that the patient is educated about his or her deficit and provided with a layman’s explanation of compensatory strategies. Even so, simply understanding the problem is not enough. The person must practice compensatory scanning and make it an ingrained habit during their everyday activities (Hellerstein, 2002). Management should include optical and nonoptical devices with focus on the functional activity the person wishes to perform.

## Effects of Visual Function on Other Rehabilitation Therapies

According to Hellerstein (2002), vision that is the primary sense for obtaining information from the

environment is overlooked in rehabilitation after a stroke. Initially, life-saving measures are provided during the initial stage of the disease. Once the patient is medically stable, the functional aspects of vision are frequently overlooked. Several thousands of dollars may be spent on rehabilitation without addressing the visual implications of stroke. Ways the vision rehabilitation professionals and other rehabilitation professionals (e.g., occupational therapists, physical therapists, speech and language therapists, kinesiotherapists) may work together include:

- Providing patients with training on how to scan or locate objects in the affected field while learning to feed themselves.
- Making sure the patient is prescribed appropriate glasses to “see” the task before being taught to read or use the computer.
- Consulting with one another in regard to reteaching walking while the patient is patched for diplopia, as patching may have a negative effect on balance.
- Consulting with the low vision optometrist in regard to the patients who have vestibular dysfunctions causing dizziness, vertigo, or balance problems. Wearing invisible or no-line bifocals may aggravate the dizziness and cause a decrease in balance.

In addition, many who have been diagnosed with “mild” brain injuries often exhibit subtle vision-related issues, such as sustaining near tasks, poor depth perception, loss of place and skipping lines when reading, and headaches. By consulting with vision rehabilitation professionals, difficulties may be identified and ameliorated early on in the rehabilitation (Hellerstein, 2002).

## Therapeutic Cost

In general, we have found that optimal training with prisms ranging from 5 to 15 sessions. Additional visual rehabilitation services are dependent on the difficulty the patient has, as well as their personal goals. Fresnel prisms cost around \$20 each, whereas ground-in prisms range from approximately \$600 to \$1,000.

## Conclusion

Because there have been wide variances of the results from visual search training, prism therapy,

or visual restorative therapy, when working with the patient with hemianopsia, the decision on which treatment option to pursue must be made according to the individual’s needs and requirements. In order to treat the person as a whole instead of parts of a whole, it is crucial that vision-related services and other rehabilitation services work together to provide a comprehensive, multidisciplinary approach toward each patient in preventing falls.

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# Mnemonic Devices for Braille Instruction

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## Abstract

Mnemonic devices have been used to assist learners to assimilate new concepts since the 1950s. They have been used to teach many different subjects and levels of learners including those identified with disabilities. These learning aids have been identified as promising tools because they provide an interactive, motivating, stimulating, and satisfying approach to learning. Both learners who are sighted and those who are visually impaired can use mnemonic devices to strengthen their ability to recall the braille characters and contractions as well as the rules that accompany their use. Five separate categories of mnemonic devices are presented along with specific examples of mnemonic devices that have been created for teaching and learning the braille code.

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Keywords: braille instructional strategies

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## Introduction

Learners actively search for connections. They call upon memories and previously learned concepts to understand and make sense of newly introduced concepts. As early as the 1950s, researchers found that individuals can increase cognitive performance by clustering or unifying pieces of new information and attaching them to previously learned concepts (Farenga, Ness, & Flynn, 2007). One way to do this is by creating mnemonic devices. Mnemonic devices have emerged as tools that can be used by people with sight and those who are visually impaired to assist in learning the braille code.

## What Are Mnemonic Devices?

Mnemonic devices are memory enhancing strategies that help individuals link new information to previously learned information. They have been used to improve memory of key information by providing assistance needed to better encode information so that it will be easier to retrieve from memory at later times. Mnemonics are useful for individuals across a wide age range and ability level including young students and elderly adults. They have been used in many different academic subjects including language arts, vocabulary, spelling, mathematics, science, social studies, and foreign language (Hwang & Levin, 2002). Educators have promoted the use of mnemonics because they do not require extensive training, planning, or additional materials (Mastropieri & Scruggs, 1998).

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## Mnemonic Devices for Braille

Mnemonics are strategies that provide a visual or auditory prompt for students who may have difficulty retaining new information. Students whose learning modalities are primarily visual or auditory are able to create a picture, word, rhyme, or sentence that is attached to an idea they already have. Mnemonic instruction follows the premise that as people learn, they are building a web of knowledge. Learning something new is like adding a thread to the web. For students with memory challenges or processing disorders, mnemonic devices become the tools to build threads that connect new ideas to those previously learned.

### Categories

Five different categories of mnemonic systems have been reported. These include key word, acronyms, acrostics, rhymes, and peg words (Kleinheksel & Summy, 2003). The following is a brief explanation of each category.

#### Key Word

Key word links a known word to an unfamiliar word through a meaningful visualization that interacts with the meaning. For example, the word *jettison* could be linked to *jet* (Uberti, Scruggs, & Mastropieri, 2003). The learner is asked to picture cargo and luggage being thrown from a jet. The key word mnemonic strategy is used essentially for learning new vocabulary words.

#### Acronyms

Acronyms are a type of mnemonic that can be used to memorize lists of words by taking the first letter of each word and arranging them in a meaningful order (Uberti et al., 2003). A common acronym is HOMES, which is used to remember the names of the five Great Lakes: Huron, Ontario, Michigan, Erie, and Superior (Kleinheksel & Summy, 2003).

#### Acrostics

Acrostics are similar to acronyms and sometimes grouped with them in the same category of mnemonic device. Sentences are created with words that start with letters. The first letter of each word corresponds with the word to be remembered. An example is “**M**ary **n**ever **e**ver **m**issed **o**ne **n**ight in **c**lass” because it can be used to remember how to spell the word *mnemonic* (Singh, 2007). Another way to use acrostics involves the number of letters in

each word. By remembering the sentence “How I wish I could recollect pi easily today,” the first nine digits of pi (3.14159265) can easily be retained by counting the number of letters in each word of the sentence (Farenga et al., 2007).

#### Rhymes

Rhymes are used by setting information to music. Days of the week and months of the year are frequently learned through this approach. Many students learn the state capitals or parts of the body through music.

#### Peg Words

This strategy can be the most complicated. It is effective when it is necessary to learn numbers or ordered information. A simple example is visualizing a woman dressed as a knight riding a horse to the voting booth. The word *knight* should be associated with the number 19. The 19th amendment of the U.S. Constitution guarantees women the right to vote (Kleinheksel & Summy, 2003). An important feature of this category is that the picture created should clearly and vividly connect to the new information in an organized fashion so that the learner can build on previously learned knowledge.

The type or category of mnemonic device used is typically determined by the information being taught. Some information can easily be learned with multiple mnemonic strategies. The learning style of the individual should be considered when making a choice of which mnemonic strategy to use.

### Evidence of the Effectiveness of Mnemonic Devices

There is a large professional research base reporting the effectiveness of mnemonic devices with regard to learning. Bellezza (1981); Bower (1970); Carney and Levin (1991, 1998, 2000, 2008); Krinsky and Krinsky (1994); Levin and Pressley (1985); Pressley, Levin, and Delaney (1982); and Wang and Thomas (1995) are just a few researchers in the area of memory who have examined different aspects of the use of the different categories of mnemonic devices with various populations of students and adults. More recent research has shown that mnemonic devices can be enjoyable, engaging, and highly successful strategies that can be employed to help learners retain new information

and boost academic performance (Kleinheksel & Summy, 2003). Such strategies were first reported being used in the 1950s by college students learning a foreign language (Uberti et al., 2003). Since then, researchers have shown that changing the way information is encoded can lead to improvement of retrieval, and therefore, increased test scores can be documented for learners, including those with disabilities, of any subject matter (Uberti et al., 2003).

Mnemonic instruction has been well researched and validated for individuals with differing abilities and ages including those with high-incidence disabilities, students in elementary and middle schools, and adult learners. The use of mnemonic strategies has helped these students improve their academic achievement (Bugg, DeLosh, & McDaniel, 2008). Research later extended the use of instruction into classrooms of younger students in special education (Kleinheksel & Summy, 2003). Because organization and visualization, two important factors in memory, are employed through mnemonics, students with learning disabilities were shown to match the achievement of those without disabilities by using the key word method (Farenga et al., 2007; Uberti et al., 2003).

Research suggests that memory, content knowledge, and learning strategies all affect a student's performance (Farenga et al., 2007). Everyone has a limited ability to learn new tasks. However, students who examine collections of data and determine a rule for grouping information can recall more information than those using a rote repetition strategy (Farenga et al., 2007). Bugg et al. (2008) state that the mnemonic benefit of semantic processing is one of the most widely held ideas to come out of the memory literature. They found that university students were highly motivated to utilize the strong mnemonic advantages of semantic processing over nonsemantic study habits because the latter were not as beneficial (Bugg et al., 2008).

Recent research has shown that by distinguishing between similarities and differences among group members, learning and retaining material can be accomplished more effectively. Mnemonic devices are more memorable if positive and pleasant images are used because the brain tends to block out unpleasant images (Singh, 2007). Funny or peculiar images will be remembered longer than normal, uneventful ones. Likewise, for more mature learners,

rude or sexual connotations can be hard to forget. Finally, symbols can be used very effectively, as can the applying of imagery to all five senses whenever possible (Singh, 2007).

Caution should be used when teaching mnemonic strategies. Research has found that learners who benefit from their use may not be able to construct their own mnemonic strategies independently (Hwang & Levin, 2002). Instructors may need to assist in the development of the devices for students when first introduced to using them depending upon age level and individual needs (Scruggs & Mastropieri, 1992).

## Mnemonic Devices and Braille

Because the braille cell contains only six dots, there are many potential issues in remembering dot combinations and the many rules that dictate their use. There have been no formal studies examining the use of mnemonic devices with students and adults who are learning the braille code. However, in one author's 21 years of experience as a braille instructor, adults who are sighted and those who are blind, as well as young students, have reported that mnemonic devices have assisted them in remembering the braille dot combinations and usage rules, especially in the initial stages of learning. In addition to learning the 26 letters of the alphabet, braille learners have 189 contractions to recognize, identify, and apply based upon the rules that dictate their use. Contractions are dot combinations used in the braille code that may represent all or part of a word. These contractions are divided into groups based upon their function in a word. Braille learners are typically taught these contractions group by group. Braille instructors have anecdotally reported mnemonic devices that braille learners who are sighted and those who are blind have used to assist in learning the code. Some mnemonic devices are more applicable to one population or another (learners who are sighted or blind) or to individuals of different ages, so the instructor needs to determine whether using the device will cause confusion for each particular learner. This is especially important given that devices that work with adults may not be effective with younger students; the latter may not have a

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referent or prior knowledge upon which to draw, so linking the device may be difficult. Ideas reported are as follows:

- Example of a visual reference:  
The letter *e* points down to the earth and *i* points up to the sky, especially when capitalized ( $e=⠠⠠⠠$ ;  $i=⠠⠠⠠$ )
- Example of an auditory reference:  
The letter *h* stands for 8 and *i* stands for 9 because they have similar vowel sounds. The characters used to write a letter *h* in braille are the same as those used for a number 8 ( $⠠⠠$ ). The characters used to write a letter *i* in braille are the same as those used to write a number 9 ( $⠠⠠$ ).
- Example of a mnemonic device that uses prior knowledge:  
The letter *g* stands for 7 due to the guitar chord G7; the dot combinations for the letter *g* are the same as those for a number 7 ( $⠠⠠$ ).

Some braille letters look much like their print partners such as *l* ( $⠠⠠$ ) and *p* ( $⠠⠠$ ), which is helpful only to those who have knowledge of print prior to learning braille. Other braille learners often hear themselves say “fix” while brailleing the number 6 ( $⠠⠠$ ) which is also the letter *f* but without a numeric indicator. The letters *f* ( $⠠⠠$ ), *d* ( $⠠⠠$ ), *j* ( $⠠⠠$ ), and *h* ( $⠠⠠$ ), are each composed of three dots and are common reversals. They happen to fit directly in the four corners of a piece of paper. Starting at the top left corner and going clockwise, the mnemonic “fast (f) dogs (d) jump (j) high (h)” can help some students remember the correct formation of those dots.

Contractions can be difficult for students to remember. Examples of mnemonics that may be helpful in remembering contractions include:

- *And, the, for, a, of, and with* are special “royals” because they are the only ones that can be grouped together without a space between them; they are quite snobbish and they only stick to their own kind
- *With* has a braille letter *w* in it, whereas its mirror image *of* contains the braille letter *o*
- *Ch* represents a mother and child—high dot and low dot
- *Less* has a taller dot before the letter *s* (dots 4 and 6). Its partner *ness* uses dots 5 and 6, which is shorter because *n* is shorter than *l*

- The contraction for *com* is completely dropped to the bottom of the braille cell (dots 3 and 6), whereas *con* uses dots 2 and 5
- The contraction for *which* is *wh* and is the shape of a witch’s nose (dots 1, 5, and 6)

Mnemonics can help braille learners remember capitalization and punctuation, as in the following examples:

- The exclamation point is a person with his back to the sentence, yelling at the next sentence. It is a dropped *f*, which stands for “Fact!”
- The period is a *d* dropped to the bottom of the cell for “Done.”
- The question mark is the *h* dropped to the bottom of the braille cell and stands for “Huh? What did you say?”
- The capital sign is married to the letter with no space between them: Do not incorrectly insert things between the two that would break up the marriage.

There are many rules that need to be learned and applied when learning the braille code. Mnemonic devices can be helpful in remembering and applying these rules. For example:

- To explain the rule of not having two lower cell signs in succession without being in contact with an upper cell dot, remember “you cannot build a house with two basements and no upper floor” or “you cannot leave little children alone without a grown up (upper dot)
- There are medial contractions that are sometimes called “sandwich contractions” because they can only be used in the middle of a word; these include *ea, bb, cc, dd, ff, and gg*

Learning a few key sentences is a good way to remember contraction groups. These groups of contractions consist of whole-word and part-word signs.

- **These over there are theirs.** (dots 4,5 the; dot 5, the; dots 4,5,6 the)
- Go **through those** books. (dot 5, th; dots 4,5 th)
- **Where** did you learn that **word**? (dot 5, wh; dots 4,5, w)



- **Whose** hat is **where** I sat? (dot 4,5, wh; dot 5, wh)
- **Here, there, and everywhere.** (dot 5 words)
- **Upon my word, these are those whose** dots are 4 and 5. (dots 4 and 5)
- **Many** in this **world cannot** have **had their spirit.** (dots 4, 5, and 6)
- **Ought one ever question mother, father or lord?** (dot 5 words)
- **Some young characters know right where the part works.** (dot 5 words)
- **Through here, under there, name, day, time.** (dot 5 words)
- The **sound** of the **dance** from the **mansion** is **useless** to **count.** (dots 4 and 6)
- **Hence Kong's awful actions** harnessed an **element** of **pity.** (dots 5 and 6)
- R2 D2 is only typing Gs on his PC. (receiving, rejoicing, declaring, deceiving, perceiving and conceiving)

The letter *a* has more contractions than any other letter. A few ideas to remember these include:

- According (ac) to the instructor, you need an *R* to go across (acr) the river.
- ABCFGL is a collection of whole word contractions that start with *a* and have one other letter: *about, according, after, again, and also (ab, ac, af, ag, al, respectively).*
- *Above, across, afternoon, afterward, against, almost, already, altogether, and always* are the whole word contractions that start with *a* and have two other letters.

Finally, students have come up with jingles or rhymes to remember the contractions. Many are nonsense, but if they work for a student, the student uses them to help trigger memory. For example, a student reported that the following jingle as helpful for learning the contractions *ch, gh, sh, th, wh* and remembering how they are associated with the first five letters of the alphabet and dot 6: **a chic baby ghost caught sheep dogs throwing egg whites.** Another student used the same jingle but related the use of the letter *a* with the dot 6 attached. Instead, she saw things backward. For instance, *sh* is a backward *m*. She thought, “Mary turned around and went, ‘shhhhh!’” and pictured the scenario in her mind. Pictures seem to work

better for some students than rhymes depending upon whether their primary learning style is verbal (auditory) or visual.

Students also use intonation of their voice when saying different contractions as a reminder of what it looks like in braille. For example, a student's voice may go up high when saying *st* (dots 3 to 4 look like a line going up) and go down lower for *ch* (dots 1 to 6 as it starts high and then goes low).

## Final Thoughts

Teachers can use mnemonic devices to strengthen a learner's ability to recall different aspects of the braille code. This interactive and stimulating approach to learning cannot only help students of all ages remember the braille code but can also be motivating and satisfying. Mnemonic device instruction is simple because it requires minimal teaching experience and no additional costs for materials. Mnemonic devices can be instructor-created or learner-created; however, the teacher should not create and introduce mnemonics until students learn how to properly use them. Potential limitations of the use of mnemonic devices should be noted and monitored. Mnemonic devices do not always help students understand the material because they can be memorized and then easily forgotten. They can be complicated or confusing and may cause concepts to be even more difficult to learn. Mnemonic devices that work with some students may not work with others. Students should be allowed to create their own mnemonic devices when they are comfortable using them and are able to create them with appropriate and correct information. This low-tech strategy that has shown promise for learners with mild-, moderate-, and high-incidence disabilities as well as typical students and adults and thus could easily be used as a strategy for assisting both those with sight and individuals with visual impairments of all ages in learning the braille code.

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