

## LightAide Implementation: Using Interactive Light to Assess, Practice, and Learn

### Introduction

The LightAide is a new and unique assistive tool for children with visual impairments. Designed by Philips Color Kinetics and marketed by Perkins Products, it incorporates interactive displays of 224 multicolored LED lights for use with a flat black or high-resolution lens. Design features make it portable, lightweight, and easy to set up and use. It connects to an external power supply and has switch connections. These offer opportunities for four learners to control and activate the lights and for interactivity between a leader and up to four children. A control panel on the side allows the adult who is working with the children to adjust the brightness of the lights, select their color, and choose activities from a pre-loaded Starter Activity Set for mathematics, English language arts, and life skills.



**Figure 1. The LightAide**

The LightAide, shown in Figure 1, became commercially available from Perkins Products in September of 2013. With the support of Perkins Products in identifying purchasers, researchers from TERC—a Cambridge, MA-based research and development organization—conducted implementation research to begin to identify the characteristics of LightAide users, to find out how the device is being used with learners who are visually impaired, and to explore its potential benefits. To accomplish this, the study focused on three research questions: 1) What characterizes LightAide users? 2) How do teachers and parents use the LightAide to meet learners' needs? 3) What are the benefits of LightAide use? Participants included parents and

teachers who had recently purchased the LightAide and had been using it for a short period of time. Also included were those who had purchased it a year or more ago and were continuing to use it.

This report presents the outcomes of this research. The information provided is intended to help parents and professionals develop awareness of the strengths of the LightAide and think about how they might use it with learners who are visually impaired.

### Methods

A mixed-methods research design (Creswell & Plano Clark, 2007; Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie, & Turner, 2007) that resulted in qualitative and quantitative data and builds on the methodology TERC has established for similar studies was used to begin ascertaining the characteristics and needs of LightAide users, how the LightAide is integrated into teaching to meet the needs of users, and benefits of use. Research was coordinated and conducted by TERC with teachers and parents who were solicited from a list of LightAide purchasers. Purposeful sampling (Palinkas et. al., 2013) resulted in the selection of users who had recently purchased the device and were currently implementing it in a classroom or home with learners who are visually impaired, or who had purchased it previously and had been implementing it with this audience for a year or more.

TERC has an Institutional Review Board that is overseen by the U.S. government's Office for Human Research Protections. Its Federal Wide Assurance number is FWA-00010418. This study involved only adult human participants. Informed consent was obtained from all individuals surveyed and interviewed. Data-collection methods involved: 1) soliciting parents and teachers; 2) gathering responses to an online survey; and 3) conducting follow-up interviews with a subset of parents and teachers who responded to the survey. A link to the

online survey was sent to teachers and parents who met the selection criteria and expressed interest in participation, along with an introductory note that described the study protocols. A subset of participants who completed the online survey and had agreed to be interviewed was identified for phone interviews, which were then set up and conducted.

Online implementation surveys were used to collect data. These rendered information about user demographics, implementation of the LightAide package, and benefits of use. An Interview Form was used to guide conversation that would provide more specific information about implementation related to meeting learners' needs than was available from survey responses. Data collected from the instruments were entered into spreadsheets, cleaned, and analyzed.

## Results

### **Research Question 1: What characterizes LightAide users?**

The study involved 12 teachers and 7 parents. The teacher sample included those who taught in public schools, specialized schools for the blind, a pediatric nursing home, and a specialized school for students with disabilities. The sample comprised classroom teachers, itinerant teachers, and teachers of the visually impaired. Students who used the LightAide and participated in the study were mainly in preschool through grade 3. All had cortical visual impairment (CVI). The majority also had cognitive delays and severe multiple impairment. Learners who used the LightAide at home with their parents and participated in the study were, with the exception of one child, in preschool through grade 3. All except one had CVI. Several also had cerebral palsy and/or cognitive delays.

Taken together, these characteristics offer a snapshot of the learners who use the LightAide and of the adults who use the device with them. In sum, users are young learners with

multiple disabilities that include low vision. They do their learning in a broad range of settings. The adults are the parents or teachers who work with them regularly at home or in school and who are in the initial stages of exploring opportunities that involve use of the LightAide for teaching and learning.

**Research Question 2: How do teachers and parents use the LightAide to meet learners' needs?**

Teachers and parents set up the device on a desk, table, or wheelchair, and occasionally on the floor, for use with one learner at a time. Most used the LightAide daily or every other day and limited use to short bursts that lasted anywhere from 15 to 30 minutes. They found this was enough time for the tool to be effective; it was also an appropriate span for learners to remain focused and engaged.

Without exception, teachers and parents were able to find practical ways to use the LightAide for individualized instruction that involved ongoing assessment, practice, and learning. This can be largely attributed to the device having been “universally designed” according to the principles of the Universal Design for Learning (UDL) framework, thus maximizing its potential to remove any barriers, individualize instruction, and increase access to information for young learners with low vision (Rose, Hasselbring, Stahl, & Zabala, 2005). The UDL framework is based on the neuroscience of learning. Its principles emphasize three key aspects of pedagogy (Rose & Meyer, 2002) that are incorporated into the LightAide as follows:

- 1) Multiple means of representing information —Presenting light in different ways gives learners various methods of acquiring information.
- 2) Multiple means for the expression of knowledge—Observation, switch-operation practice, and questioning offer alternatives for assessing and demonstrating knowledge.

3) Multiple means for engagement in learning—Working with light in ways that take advantage of learners’ ability to detect and respond to it makes sense, taps into their interests, offers challenges, and increases motivation.

The following examples show some of the ways study participants used these UDL features to meet learners’ needs. The majority used the LightAide to work on increasing visual attention and tracking. For this, they used displays that show a single light, a column or row of light, or displays of light shapes moving across the screen. They used children’s interactions with these displays to observe and assess learners’ ability to attend to and track the light. This involved doing things such as having children zero in on a preferred color, then working with and watching them to see if they focused on and attended to the light and if they moved their eyes or head in a particular direction. Adults then used what they discovered to customize the tracking activity, practice and work on the skill, observe what the child could do, identify progress, and repeat the process. When used in this way, these interactions enabled ongoing informal assessment of children’s ability to attend visually and to track—such assessment informed individualized use of the selected light display for teaching.

In addition to using the LightAide for informal assessment, a teacher of the visually impaired reported that it serves as a mechanism for conducting aspects of Functional Vision Assessment related to tracking that may provide new information about children’s ability to track. For example, one child, who had previously been tested and had shown no evidence of looking, when tested using the light displays could be observed responding to the light, looking, maintaining focus, and visually tracking.

Some teachers and one parent used the LightAide to help children learn or review mathematics and English language arts content or skills included in the Expanded Core

Curriculum [ECC] (American Foundation for the Blind, 2013). This included focusing on topics such as learning to identify colors, shapes, numbers, and letters; reading sight words or rhyming words; and comparing the lengths of horizontal and vertical lines. For these purposes, they used the iterative cycle previously described for tracking—observation and assessment, customization, practice, and identifying progress—to incorporate displays that exposed learners to numbers, letters, words, colors, shapes, and lines.

Many teachers used LightAide activities that require switch operation or activation to help learners make something happen and, in so doing, experience and demonstrate cause and effect. For nonverbal children, or for those having a switch attached to a wheelchair, the teacher asked them to hit the switch until they saw a particular color. Activities that involve making changes to the LED display or playing a game such as Tic-Tac-Toe were used to help children practice taking turns.

Participants also set up the device to display lights that change color and move automatically, without switch operation, for children to view independently. Teachers used this approach to keep learners occupied while they worked with others or to give children opportunities to relax while visually attending to or watching the light. Several parents integrated the LightAide into therapy or “playtime” at home with their children, occasionally including siblings.

### **Research Question 3: What are benefits of LightAide use?**

Whether the LightAide was used at school or at home, teachers and parents agreed that the device offered them a new and different tool with many benefits. They found that it could be easily worked into what they were already doing, supplemented learning nicely, and added new dimensions to the teaching and learning of children with low vision. Pluses include the device

being large yet lightweight, durable, and easy to transport. Its bright, colored LED lights displayed on a black background make it ideal for use with learners with low vision, especially those with CVI, who often have a preference for certain colors. With the LightAide, activities can be confined to the child's preferences, resulting in effective participation and increased enjoyment in the process.

The most salient benefit of the LightAide package is that it provides an appropriate amount of visual stimulation and increases learners' ability to attend to light for the purposes of tracking, learning math and English language arts content, and acquiring ECC skills. The switch operation brings possibilities for individual or group interaction with the device. The variety of activities allows for differentiation of instruction for all students. Additional benefits are that the LightAide is engaging, motivating, and fun, and it can be used effectively in a variety of settings for therapy, group or individual academic instruction, or relaxation.

Activities that were most beneficial based on learners' needs and abilities, and the particular content area or skill that participants were working on, were as follows: For tracking, activities such as Track the Column, Track the Row, and Track a Spot, as well as others in the Visual Efficiency Activity Set, such as Build Squares of Light and Make a Rainbow, were found particularly useful. Preferences for English language arts concepts included Identify the Bold Uppercase and Lowercase Letters, Read Sight Words, Read Rhyme Words, and Form Consonant-Vowel-Consonant Words. For mathematics, they found Learn the Numbers, Identify the Shape, and Compare Lines of Different Lengths most useful. For ECC skills, they liked activities such as Identify the Color and Learn Directions. For cause and effect, Take Turns, as well as any activity that required use of a switch, was effective. Watch the Colors Change was

conducive to helping children relax while attending to light. Activities in the Game Activity Set, and fun activities such as Make and Pop Bubbles, were useful for therapy and playtime at home.

### Key Findings

The surveys and interviews of LightAide teacher and parent users show that, when it is used as an assistive tool, the device appears to have the potential to contribute to offering young learners with low vision, and with some ability to detect and respond to light, foundational pre-learning that is essential for continuing to develop a knowledge of English language arts and mathematics content and life skills. Findings also indicate that the LightAide's interactive features promote iterative individualized informal assessment and instruction with a wide range of learners with low vision and learning challenges. Adults, all of whom had used the LightAide for a limited amount of time, were able to effectively integrate it into their instruction because it provides an appropriate amount of visual stimulation, incorporates switch interaction with the light displays, and is engaging, motivating, and fun.

### Conclusions

Conducting implementation research enabled the TERC team to begin to ascertain how and for what purposes teachers and parents choose to integrate the LightAide into their teaching. We also gained preliminary insight into how interactive LED light displays can affect learning. Although this research provided important information about the impact the LightAide can have on instruction and achievement for young learners with low vision, additional research, in a wide range of settings with a larger sample of teachers and parents who have used the device for longer periods of time, is needed to explore and assess the LightAide's full potential.

### References Cited

American Foundation for the Blind. (2013). *The expanded core curriculum for blind and visually*

*impaired children and youths*. Retrieved from <http://www.afb.org/info/programs-and-services/professional-development/teachers/expanded-core-curriculum/the-expanded-core-curriculum/12345>

Creswell, J., & Plano Clark, V.L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L.A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1, 112-133.

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N., & Hoagwood, K. (2013). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*.

Rose, D., Hasselbring, T. S., Stahl, S., & Zabala, J. (2005). Assistive technology and universal design for learning: Two sides of the same coin. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 507-518). Whitefish Bay, WI: Knowledge by Design.

Rose, D., & Meyer, A. (2002). *Teaching every student in the digital age. Universal design for learning*. Alexandria, VA: Association for Supervision and Curriculum Development.