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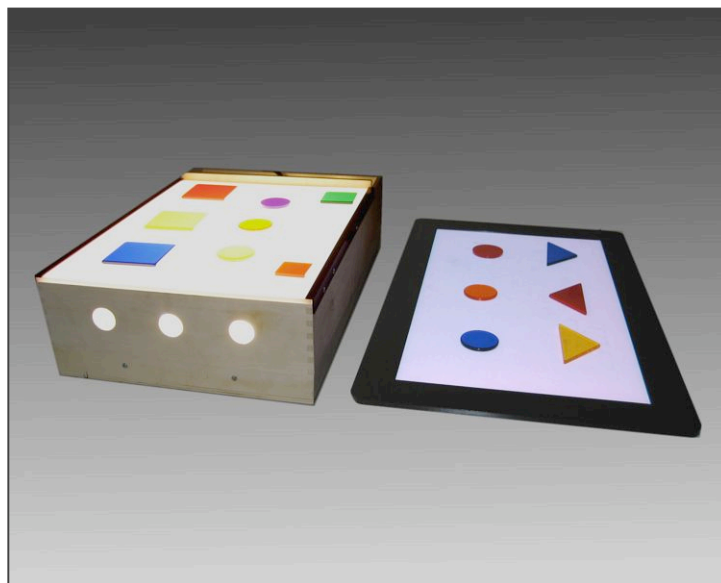
Paul Nater and Nadja Högner

Results of empirical studies on the LiteScout system

This article discusses the results of empirical studies of the “LiteScout” system, which is an alternative to the light box. The results will be used to determine the system’s suitability.

The results are from studies conducted in 2005 as part of four empirical projects at the Institute for Rehabilitation Sciences, Department of Blind and Vision-Impaired Pedagogy.

The article begins by detailing the LiteScout’s optical and mechanical characteristics. The results of the four empirical studies are discussed. The article concludes with remarks on the advantages and disadvantages of the LiteScout as compared to the light box.



Light box (left) vs. LiteScout (right)

Device characteristics

The LiteScout consists of a magnetic panel lighted using a special PLASTOLIGHT surface light. This light source generates no heat while providing high-quality, high-intensity light. It lights the panel surface evenly with no glare or flicker while delivering excellent contour sharpness. Light is emitted at a wavelength of 430 nm (bluish-white light). A continuously variable control allows the user to precisely set the desired brightness level (2004 LiteScout product catalog, p. 27).

The light surface, which serves as the unit's working surface, is made of a magnetic rubberized no-slip material. The user places transparent plastic tokens of various colors on this surface to work with them. The LiteScout uses a power supply (2004 LiteScout product catalog, p. 27).

There are two different LiteScout models available: The *LiteScout Pro* (638x8x405mm) has a lighted surface area of 538x305mm, the same dimensions as a traditional light box. This allows users to continue using all games and materials developed for a traditional light box. The system, which weighs a mere 2 kg [4.5 pounds], was developed specifically for use in early childhood special education settings and schools (2004 LiteScout product catalog, p. 3). The other available model, the *LiteScout Basic* (387x8x300mm), has a lighted surface area measuring 297x210mm (DIN A4 size). At only 1 kg (2.2 pounds), the Basic model is even smaller and lighter than its Pro cousin, making it especially convenient for home use (2004 LiteScout product catalog, p. 4).

The LiteScout system provides visual stimulation as part of an early intervention program for visually impaired and blind children as well as therapy for partially sighted adults with multiple handicaps. The LiteScout can also be used to work with physically and mentally handicapped people and assist with the rehabilitation of stroke and accident victims. The LiteScout is designed to promote visual perception, mental development, concept formation and hand-eye coordination using light, color, and contrast in combination with differently sized and shaped tokens (2005 LiteScout informational brochure). A wide range of educational and entertaining accessories made of high-contrast, highly reflective transparent colored plastic is available to maximize the device's utility. These materials include magnetic shapes in both black and many other colors (triangles, circles, squares), rods of various shapes and sizes, a fluorescent color filter, a black writing marker, and a white filter to change the default bluish-white color of the light surface. Various games with additional materials are also available and can be purchased as complete sets (2004 LiteScout product catalog, p. 5 et seq.). Students used such sets as part of their research and scholarly work.

In addition to its use as a therapeutic intervention tool, the LiteScout can also assist with diagnosis of problems with color vision and visual field deficits, including scotoma, peripheral ring scotoma, and hemianopsia, and help determine if any compensation has already occurred.

The device manufacturers provide a number of suggested exercises for the LiteScout in the product catalog (2004 LiteScout product catalog, p. 5 et seq.). However, systematically developed task sets for use with this device are not yet available. In response to this deficit, four students created task sets as part of their empirical work for use with visually impaired children requiring basic special needs intervention. Each of these task sets consists of three parts: 1. Material familiarization and basic skills development, 2. Concrete actions and higher-level skills development, 3. Increased cognitive challenge. LiteScout materials were used to develop and complete the task sets. The play guidelines in the product catalogs were used as a starting point. The objective of the students' research was to determine whether

- the selected educational and game materials worked well when integrated into a complex learning task,
- the task was appropriate from a contextual and structural perspective,
- the task was doable for children with learning disabilities and/or physical and/or mental handicaps who had impaired vision or deficits in visual perception,
- and whether measurable learning progress took place in response to increased cognitive challenges in each task set.

Each study was developed to answer its own set of questions, but all of them sought to measure the suitability of the LiteScout system for work with children who need basic special needs intervention.

A total of eight test subjects ranging from five to twelve years of age participated in the studies. The group was heterogeneous; it included children who were visually impaired but otherwise normal as well as children who also had physical disabilities and/or learning disabilities and/or mental handicaps.

The following section will summarize the objectives and results of each of the empirical studies before drawing conclusions from the results presented.

Empirical Studies: Methods and Results

The **study by G. Voigt** sought to determine whether the LiteScout was suitable for improving visual and motor skills in visually impaired children who needed basic special needs intervention.

The study found that despite near-constant exercises involving visual skills, the test subjects' failure to perform some tasks was only rarely due to their impaired vision. This means that the LiteScout can be optimized for the visually impaired; the brightness and color temperature can be adjusted to best suit each individual's needs. Visual activities are made easier by the use of colors, shapes, and contrast. Furthermore, various effects can be used to provide a change of pace and renew the user's interest in the exercises. The study also found that both the LiteScout unit and its working materials were highly stimulating. This kept the test subjects motivated and enabled them to work for extended periods of time. A significantly longer attention span was noted for all of the test subjects; this finding was supported by the subjects' ability to solve problems and advance their skills. The materials provided for use with the LiteScout allowed instructors to develop many different exercises focusing on a range of concepts, enabling instructors to concentrate on specific development targets. With respect to the development of visual and motor skills, the study found that even children with physical handicaps were able to perform many different motor movements, such as head and body movements associated with grasping and moving materials as well as drawing and coloring, as they performed the visual skills exercises. Over time, subjects were gradually able to increase the number and quality of such movements.

The results of the study show that the LiteScout is definitely suitable for improving visual and motor skills in visually impaired children who require basic special needs intervention due to visual and motor deficits. (Voigt 2005)

The **H. Müller study** specifically sought to determine whether the LiteScout could successfully improve skills in subjects with various visual impairments (impaired visual acuity, limited field of vision, partial or total color-blindness, or extreme light sensitivity).

The researcher came to the following conclusions: Due to its mechanical and optical properties (continuously adjustable brightness, homogeneous light surface, glare-free

and flicker-free light), the LiteScout is very well suited for developing the skills of visually impaired children and children with multiple handicaps. The LiteScout and the available accessories and game materials enable users to compensate to a certain extent for their visual impairments. In particular, the round colored rods, which are made of transparent plastic with fluorescent pigment to provide bright, strong color displays, were excellent at keeping the subjects' attention. As a result, the children were highly motivated and able to focus their attention longer, which enabled them to work with the LiteScout for longer periods of time. (Müller 2005)

The **study by U. Troppmann** focused on determining the suitability of the LiteScout system as a tool for diagnosing special needs and designing appropriate development activities for visually impaired children and visually impaired children with multiple handicaps. Using a set of specially developed exercises, the researcher observed whether the LiteScout could be used to formulate statements about a specific child's visual behavior, visual acuity, ability to compensate for deficits, and decision-making skills.

The study arrived at the following results: Six of the eight test subjects displayed progress in learning from the concrete-tangible level to the conceptual-abstract level. The other two test subjects, who had physical and/or mental handicaps, demonstrated learning potential relating to stimulation of their remaining vision and development of decision-making skills. The researcher's results led her to conclude that the LiteScout system was highly stimulating and that it specifically targeted the sensory, motor-related, emotional, motivational, and volutative (intentional) components related to visual image processing. When used with subjects experiencing motor agitation, attention deficit, or rapid fatigue, the LiteScout elicited extended periods of attention and concentration. Nearly all of the test subjects were able to perceive and verbalize differences in light intensity, and thus in color and brightness. Two of the test subjects expressed a preference for a high light intensity and bluish tinted light, reporting no issues with glare or excessive brightness. At no time did the researcher observe any subject complaining of eye strain or excessive glare, even in subjects who were very light-sensitive. The researcher also noted that most subjects did not want to have the white color correction filter laid over the light surface; they preferred the bluish tint. The stimulating effect of this blue light was clearly observed during all study-related exercises. Although the unit's maximum brightness setting was not a

necessity for working with any of the test subjects, a few of them did express a preference for this setting. This indicates that the unit's maximum brightness is more than sufficient for development activities. The unit and its play accessories also make it possible for evaluators to make statements about a child's visual fixation behavior, color vision, and viewing distance. It was also determined that subjects with physical handicaps had far less difficulty with visual differentiation of shapes and spatial orientation on the LiteScout viewing surface than they did while attempting comparable tasks on, for example, a paper workbook page. Subjects with mental handicaps also showed potential for growth and development: the light and color employed by the LiteScout helped focus these subjects' attention. (Troppmann 2005)

The **study by S. Helweg** reviewed the suitability and feasibility of using the LiteScout to work with visually impaired children with multiple handicaps who needed basic special needs intervention. Three test subjects were selected from the group who were in a special needs curriculum focusing on mental development. These three subjects had various handicaps (an eight year-old with Down Syndrome and severe behavioral disorders, a twelve year-old with severe multiple mental, motor, and visual handicaps, and a seven year-old with severe visual impairment with significant motor and cognitive deficits). This student's study focused on observing attention and concentration, fixation behavior, color perception, and gross and fine motor skills.

The results were evaluated with respect to these areas of focus.

Changing the colorful lighted play materials from one color to another held the subjects' *attention and concentration*, which had a positive effect on all three subjects' performance. The subjects' attention and concentration spans ranged from 10 to 25 minutes.

With respect to the subjects' *fixation behavior*, it was clearly evident that the LiteScout was able to extend fixation compared to exercises performed on a worktable. The fixation period varied from subject to subject, depending on each child's ability to recognize the play tokens.

With respect to *color perception*, the study found that all three subjects were able to differentiate and name red and yellow, although one subject displayed an uncertain color sense.

All three subjects displayed deficits in their *gross and fine motor skills*. One subject had difficulty grasping the play tokens and needed support to do so. Although all

three subjects were able to complete the first exercise, only two subjects were able to master the second and third exercises; the third had difficulty raising his arms and grasping the play tokens. The researcher concluded from the results that the LiteScout is an attractive tool for developing basic motor and sensory skills in children who have both visual impairments and cognitive deficits. The unit might also be used with mentally handicapped children who have normal vision. The subject with Down Syndrome had the most notable success with the exercise sets. His positive learning experiences had a beneficial effect on his overall behavior and his attitude toward learning, and this resulted in reduced inappropriate behavior.

With respect to the unit's suitability, the researcher was able to determine many benefits associated with its use. The continuously variable light dial allows the light to be set to the ideal level for each individual. Furthermore, the unit is nearly flat, making it easy to use for children who are very small, physically handicapped, or in a wheelchair. The homogeneous, glare-free and flicker-free light emitted by the LiteScout allows children to work for longer periods of time before they get tired. By laying worksheets or cards on the unit's surface, it can also be used as a sturdy base for work in many different school subjects. The comprehensive materials provided with the unit enable teachers to develop a wide variety of exercises or task sets. Various pictures and associated filters spur the child to grasp concepts and use his imagination. Additional picture templates can be made to supplement existing materials. Furthermore, children find the color and shape of the materials (play tokens and color filters) very appealing. The combination of light and color promotes children's attention and concentration. The unit and its accessory materials are strikingly appealing and encourage children to take an active, hands-on approach to learning. (Helweg 2005)

Conclusions

The results of these studies showed that the LiteScout system is a very suitable tool for presenting educational content through play to visually impaired children with or without multiple additional handicaps who require a basic level of special needs intervention. Given the current developmental areas of focus, the LiteScout is highly rec-

ommended for optimization of visual perception. It allows a flexible approach to learning that can be customized for each child's needs and preferences. Children can work on exercises from several subject areas at once, and the teacher can adjust the content to reflect her own specific interests or those of the child. In addition to special needs education, the LiteScout can be used for diagnosis of special needs: for example, it can be used to evaluate a child's functional visual acuity, compensation behaviors, and decision-making skills. Working with the LiteScout also allows the evaluator to draw conclusions about a child's visual contrast sensitivity, glare sensitivity, required light levels, and color vision. In light of the increased mobility required of today's special education teachers, the unit has proven itself user-friendly, practical, and effective.

The light from the LiteScout is not quite as bright as that emitted by a light box, but no one complained about this fact in any of the studies conducted. The LiteScout's slightly blue-tinted light, to which the human eye is more sensitive than white light when the surroundings are dark or only dimly lit, was clearly not an issue for any of the test subjects.

The unit's lightweight construction and flat shape, which make the LiteScout easier for physically handicapped children to use, also provide tremendous benefits to traveling teachers (early childhood development, integrative education). Because some tokens will adhere magnetically to the lighted surface, the LiteScout can be used on an easel or in a vertical position as well. It would be desirable if the manufacturer provided such an easel made specifically for the LiteScout. Also, the colored fluorescent plastic tokens could be somewhat thicker. Finally, storing the tokens in dark bags makes it difficult and time-consuming to locate any specific individual token.

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