Spatial Concepts and Balance Performance: Motor Learning in Blind and Visually Impaired Children

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Abstract: The present study addresses the main problems of blind and visually impaired children's education in relation to their motor development problems and the ways that they can be solved. We have tried to identify factors that produce motor-development differences between them and normal children; define educational strategies that contribute best to their motor development; and investigate methodically the problem considered by Warren (1977) — the heterogeneity of blind and visually impaired children's samples — through design and multivariate analysis. We evaluated balance and spatial concepts using Leonard and Hall's test. We used a stimulative program and compared the blind and visually impaired children's performances to the visually normal children's performances.

The study dealt with the main preoccupations of blind and visually impaired (BVI) children's education concerning motor learning, focusing on:
- the characterization of factors appropriate to set off the differences of development in relation to the normal child; and
- strategies for the best possible development or the minimization of already existing impediments.

Studies concerning BVI children's development usually focus on the delays in motor development and the existence of problems related to motor learning. The studies attribute them to the differences between visual, auditory and tactile-kinesthetic space, brought by difficulties in:
- recognizing the environment, due to scarce and fragmented feedback from the outside world (Adelson & Fraiberg, 1976);
- establishing the concept of object and of its permanency, caused by the problem of localizing, identifying, and reaching an object basically by its sound (Fraiberg, Sigel, & Gibson, 1966; Adelson & Fraiberg, 1976; Lissonde, 1978). Therefore, there is only a minor interaction between the child and surrounding objects, with non-development of intentional motoricity;
- developing body image and spatial concepts to determine the relative position between body and objects (Cratty & Sams, 1968; Hill & Blasch, 1980);
- establishing a motor pattern (Scholl, 1974);
- controlling the environment, which leads to the fear of suddenly facing a dangerous situation during the displacement (Lowenfeld, 1974; Martinez, 1978), resulting in immobility in the game (Burlingham, 1965);
- the overly protective attitudes of parents (Lowenfeld, 1974; Martinez, 1978), and the lack of opportunities which are essential to lead a full life (Lowenfeld, 1974).

For some authors, concept development is the key to the problem. Cratty and Sams (1968) consider as fundamental stimulating the development of the body image, which includes acknowledgement of the body's planes, parts, and movements, laterality, and directionality. Hill and Blasch (1980) and Hill (1981) consider spatial concepts, especially positional and relational ones, to have a very important role.

Others, like Leonard (1969), Siegel and Murphy (1970), and Gipsman (1981), argue that balance — demanding information from tactile, kinesthetic, visual, and vestibular systems; showing knowledge of vertical concepts by a good segmental alignment of the body; and giving information about the efficiency and control of gross motor skills — is the key for the problem of BVI children's orientation.

Siegel and Murphy (1970) think that vertical concepts can be learned visually or kinesthetically. Scholl (1974) emphasizes body control in acknowledging positional relationships toward others and toward surrounding objects. This control and acknowledgement demand, according to Arnheim, Auster, and Crowe (1977), the development of an orientation toward gravity, laterality, and directionality.

In our study, we felt that motor development, more than with normal children, is dependent, in blind, low-vision, or other visually impaired children, on:
- the acquisition of spatial concepts, the knowledge of how body parts are positioned and related to one another, as well as the way these concepts can be translated externally;
- the knowledge of the body's gravity center, base of support, movement patterns, and environment;
- the ability to distribute body weight evenly during movement;
- the belief that these children need more self-protection, the lack of which inhibits them from moving freely;
- the incomprehension of their special needs;
- the importance given by the family and teachers to motor behavior and learning; and
- the difficulty of providing different kinds of motor experiences leading to the conception and understanding of environmental space.

Therefore, significant improvement in orientation and mobility as well as in motor behavior and learning depends essentially on:
- appropriate auditory, tactile-kinesthetic, proprioceptive, and visual stimulation;
- a well-structured, organized and developed group activity offered by the physical education and mobility teacher in order to obtain meaningful wholes by unifying experiences and maximizing the learning time;
- a teaching style with more cognitive appeal; and
- a space rich in different kinds of sensitive cues, which create the necessary safety to control the pedagogical space and the desire of movement.

Objectives and methods
The aims of the study were to evaluate positional concepts and balance performance and to try to point out the most
important conditioning factors; and to determine the effects of two different kinds of pedagogical situations: one with more cognitive activity and less motor activity and the other with more motor activity and less cognitive activity.

We applied the Hill Performance test of selected positional spatial concepts and an adaptation of Leonards test, having collected information about:

- the family in terms of child overprotection and its socioeconomic level;
- development concerning age, walking age, sex, age at onset, IQ, visual acuity and field, etiology, the presence of nystagmus, auditory and vestibular functions; and
- learning, e.g., school grade, success in school, writing in inkprint or braille, information the teacher has about the level of orientation mobility and motor control.

The ensemble was composed of:

- Sixty-seven BVI children (50 aged between 6 and 10; 17 between 11 and 13 years, with visual acuity (VA) between 0.0 and 0.3. Seventeen were totally blind, 19 had 0.0 < VA < 0.05, 17 had 0.05 < VA < 0.1, and 14 had 0.1 < VA < 0.3 without other evident problems.
- One hundred and fifty sighted children, aged between 6 and 10 (15 boys and 15 girls for each age), of the same socioeconomic level, whose birthday had occurred two months before or after the test application in order to obtain the normal performance of these ages.

Four different samples were organized with the following correspondences: 1) to the determination of the most important factors in the 67 BVI children's performance of balance and positional concepts; 2) to the pretest and posttest comparisons of the two groups of 13 children each, subjected to a training period, although with different pedagogical situations; 3) to the characterization of the differences between 47 normal and 47 visually impaired children; and 4) to the study of 26 visually impaired children's evolution after a training period, comparing this to the normal evolution.

The experimental procedure was not always the same. Thus, the BVI children were subjected, at the beginning of the work, to two periods of evaluation. Among these, 26 were subjected further to a third one at the end of the learning period, composed of 40 sessions of 45 minutes each. The sighted children were subjected to just a single evaluation period.

For the application of the Hill and Leonard test, three teams were trained in order to obtain the necessary inter-

individual fidelity. To evaluate the time that teachers devoted to corresponding activities, to spatial orientation, and to balance, six sessions were observed during the training period. Three elements took part in that observation, noting the time allocated by the teacher to each activity, attendance, the teacher's feedback and the time engaged by the student. These sessions were videotaped.

We performed a multivaried analysis of main components, avoiding the necessity of constructing homogeneous groups, and allowing the control of heterogeneity by determining its influence on the results. The analysis of main components, together with automatic classification, contributed to the elaboration of subgroups, characterized by a whole of variables and of results, which clarify the influence of the heterogeneity. On the other hand, it allows for the comparative analysis of pre- and posttest situations with the performance of other children not subjected to a training program. This avoids the difficulty of homogeneity in constructing an experimental and a control group to determine the reliability of a pedagogical situation.

In the same way, the evaluation of each child is now considered in connection with the performance of its initial subgroup, comparing this with its final subgroup; and the average performance of BVI and sighted children.

Conclusions

We have concluded that the differences between the BVI children and the sighted ones are basically founded in balance performance.

Concerning positional concepts, the differences are related to the body's ability to move in relation to objects as well as its ability to form object-to-object relationships. The major problems are related to lower ages (6, 7) and lower school grades (preschool), as well as lower IQs. The better results are independent of visual acuity and field.

It seems that the imbalance in BVI children, when compared with normal children, is related to lower visual acuity, alterations and reduction of visual fields, alteration of the vestibular system, the use of the tactile channel for reading and writing, and the presence of nystagmus.

When comparing BVI children among themselves, lower values of balance deficits were found in the presence of nystagmus, visual acuity superior to 0.1, nearly normal visual fields, and subnormal vestibular response. We also have seen that braille reading and writing do not explain the differences between them.

The information from the physical education and mobility teacher reflects accurately the performance of balance and spatial concepts, which seems to indicate that the variables considered in our study are representative of motor-control and mobility difficulties of those children.

The factors explaining the differences in performance of BVI children among themselves, and between them and the sighted ones, may only occasionally explain their evolution (positive or negative).

This seems to depend on created pedagogical situations, namely:

- the descriptive positive reinforcement given by the teacher;
- the different kinds of sensitive cues, which help in self-evaluation and self-control of the task; and
- the child's engagement and the time he or she spends on the task.

When the two situations are compared, it becomes clear that the situation producing stronger cognitive appeal and with more time for spatial organization tasks clearly favors progress in the performance of those concepts. BVI children under this program reach a level similar to that of children with normal sight.

The evaluation of balance performance didn't show significant differences between the two groups. However, greater progress was made by the group that was in a situation of stronger cognitive appeal. Similar durations were used for balance activities for both groups (more or less half of the time was used in the situation of stronger cognitive appeal for spatial organization). Compared with normal children, the development is not very significant.

The lesser time spent on spatial organization (nearly half of the time was spent in the situation of greater cognitive appeal) might have contributed, besides the visual deficit and the alterations in the vestibular system. As a synthesis, one might say that the observed evolution with regard to spatial organization demonstrates the role that stimulation can play and the advantage of situations with greater cognitive appeal.

References


Mobility in Individuals with Moderate Visual Impairments

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Abstract: This article reports the results of a study to assess variations in the indoor and outdoor locomotor mobility of 22 low vision adults. Visual acuity, visual field, and contrast sensitivity data were obtained on all participants. Participants were also videotaped while walking unfamiliar indoor and outdoor routes under normal and reduced illumination. These videotapes were viewed by an occupational mobility instructor, who recorded such incidents as stopping or contacting objects during travel. Mobility assessment data obtained from the videotapes were analyzed in relation to type and degree of visual loss. Individuals' visual fields and contrast sensitivities were found to be related to mobility performance, whereas their visual acuities were not. Visual field and contrast sensitivity together accounted for 39 percent of the variation in mobility performance. Results of the study are discussed in regard to the importance of visual contrast sensitivity and visual field for functional activities such as mobility.

In this study, variations in type and degree of visual impairment among individuals with moderate losses of visual sensitivity are related to their mobility in outdoor and indoor situations. Vision was assessed in terms of contrast sensitivity, visual acuity, and intactness of the peripheral visual field. Mobility was assessed in terms of pauses, collisions with objects, and other problems encountered by low vision persons walking quarter-mile-long indoor and outdoor routes under high and low levels of illumination. New adaptations of methods to assess the mobility skill of visually impaired persons and report the relation of variations in functional vision to mobility are described.

There are relatively few research reports about or training materials for the mobility needs of low vision persons compared to those for totally blind persons. Published summaries of knowledge about teaching techniques, for example have focused mainly on persons without useful vision (Hill & Ponder, 1976; Welsh & Blasch, 1980). Similarly, research on mobility has focused mainly on blind persons and consists mainly of observational studies aiming at creating objective reliable measures of mobility (Armstrong, 1975; Dodds, Carter & Howarth, 1983; Shingle-decker, 1983). Except for Marron & Bailey (1982) and Pelli, (1986), we are unaware of any experimental or observational studies on the mobility of low vision persons.

There is considerable reason to believe that many persons with low but usable amounts of vision have difficulties with independent travel in many situations. One of the most systematic sources of knowledge in this area is a survey by Genensky, Berry, Bikson, and Bikson (1979). They surveyed the beliefs of 94 low vision adults, 43 percent of whom were cane users. Their questions concerned how often these adults traveled independently, in what situations they traveled, and which situations were found to be most problematic for independent travel. Almost all the participants reported that they sometimes traveled outdoors.