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ABSTRACT

The concomitant effects of skill acquisition in hierarchical learning sequences of visual motor programming and the ability to copy designs was compared between five- and ten-year-old children with visual motor disability. Each group of children participated in four types of visual motor training programs, which included 72 responses in each hierarchical learning sequence extended over a six-week period. Programming was implemented through individually prescribed instructional procedures. Pretest and posttest data were acquired on both the Beery Visual Motor Integration Test and placements in the hierarchical learning sequences. The results of the study indicated that the older group of children with visual motor disability learned at significantly greater rates than the younger group in the motor programming. However, there was a significant difference between groups, and the younger group showed greater ability to copy designs. Procedures for selecting specific motor programs based on individual need, rather than programming all children to the same type of perceptual motor activity, are suggested as a future procedure to enable transfer of the acquisition of visual motor skill to ability to better copy designs. (Author/JS)

EFFECTS OF SKILL ACQUISITION IN VISUAL MOTOR TASKS ON ABILITY TO COPY DESIGNS BETWEEN FIVE AND TEN YEAR OLD CHILDREN WITH VISUAL MOTOR DISABILITY

by
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The literature is not clear concerning the effects of Visual-Motor Training Programs on the acquisition of cognitive tasks. (Klesius 1971) Strong theoretical justification for the implementation of such visual-motor programming has been provided (Barsch 1967, Dunsing and Kephart 1965, Getman 1965, Hendrickson 1969) for children with learning disability. In a concensus of the research conducted to determine the effects of such programming to reading (Klesius 1971) indicates that there are discrepancies as to the effects visual motor programming has on the acquisition of reading. His review indicates there are indications that children of ages five, and six are most amenable to the perceptual motor training (Klesius 1971). It appears that there may be a critical period in visual motor development when visual motor activity may have the greatest impact on concomitant development of cognitive tasks. There are indications that the development of the posturing mechanism and abilities to move and visually interpret the environment may have impact on the development of the visual processes during this period. (Hendrickson 1969)

Prior studies have been primarily interested in the effects of perceptual motor training programs on reading. However, Simpson (1960) and Townsend (1951) have indicated a relationship of the ability to copy designs and reading. In as much as the copy of designs requires that the performer structure visual symbols in temporal spatial relationship through a process of integration, a possible avenue of exploration to determine the effects of perceptual motor activity on cognitive tasks might be to determine the concomitant effects of acquisition of visual motor skill to increase ability to copy designs.

Few studies on the effects of perceptual motor training programs on cognitive tasks specify conditions under which perceptual motor programs are appropriate. And most studies have relied on group data using activities which lack specifity to each learners diagnosed level of development for each day. Few studies have been conducted which specify all behaviors performed by each subject with a rationale for selection of each activity based upon acquisition of prerequisite behaviors in a developmental hierarchy selected according to current learner functioning each day. Another problem in the interpretation of the literature which purports to establish relationships between academic tasks and perceptual motor training programs is the lack of information as to the specific tasks that were presented to each learners. There is an apparent need to establish relationships between specified motor activity which can be quantified and reproduced to cognitive performance according to precise behavioral prescriptions that have been provided to each subject in the study. The Individually Prescribed Instructional System (Lindvall and Bolvin 1967) through the utilization of hierarchically arranged sequences has the capability to quantify and measuring the specific behaviors that have been acquired by each pupil. Therefore, with such an instructional procedure, it is possible to reproduce the behaviors of a specific hierarchical learning sequence based upon the differential needs of each child as measured by a hierarchically arranged sequence.

The Beery Visual Motor Integration Test (Beery 1967) is a copy of design test which is based on the position of symbols in relationship to one another in space. The scoring of this test can be quantified and compared to chronological norms. The purpose of this study was to explore the concomitant effects of acquisition of skill on visual motor tasks and a cognitive copy of design test of children with learning disability of differential ages through the Individually Prescribed Instructional System.

PROCEDURES

The population used for this study were two groups of children with learning disability which were referred to a clinic of the Butler County Pennsylvania Association for Children with Learning Disability. These children were referred to the Association by educators who after diagnostic tests had indicated the children as learning disabled. The Beery Visual Motor Integration test of copy of designs was used to determine each child's ability to perform on visual motor tasks. The target deficit area of proposed remediation was in the visual motor sphere. Therefore, this test instrument was used to ascertain whether the children possessed visual motor disability as measured by this instrument. Those children who were retarded more than 15% of their chronological age on the Beery Visual Motor Integration test were eligible for the study. For instance, a child who was 80 months of age he must function at a level chronologically according to the test norms of 12 months below normative standards (15 X 80 = 12 mo.), to be selected for the study.

Population

The population was composed of two groups of children with visual motor disability. One group (of 8 children) was between the ages of 60 and 78 months with the mean age of 68 months. The other group was composed of 8 children with visual motor disability with an age range of 120 months of 132 months, the mean age was 125 months.

Treatment

Each group was provided with four hierarchical visual motor development sequences which could be measured in terms of quantified gains in the hierarchical structured sequence. (Auxter 1971, Runac 1972) Each child was assessed for initial placement in the hierarchical learning sequence of activities at his functional ability level and individually prescribed activities were administered according to his emerging abilities. The curricula were implemented over a six week period, two times per week. Each subject made six responses in each of four learning sequences each session. Therefore, the total number of responses was 72 for each of the four activity sequences which were implemented.

The Nature of the Hierarchical Structured Learning Sequences

The hierarchical learning sequences constructed for this project are described in (Auxter 1971) and Runac 1971). Two of the sequences which were selected involved the perceptual factor of laterality (Kephart and Dunsing, 1965) which is defined as an internal awareness of the right and left side of the body which involves the balancing mechanism to right the posture on the lateral axis. One was dynamic and the other static in nature.

Another learning sequence was designed to develop the construct of kinesthetic motor awareness (Kephart and Dunsing, 1965). It is a perceptual theoretical construct which involves differential motor experiences which provide feedback to higher cortical centers as to motor consequences. Movement input is stored by systematic gathering of information which is the result of movement exploration. A scooter board was used to measure differential movements of activities according to the distance the board would move over time. Differing positions were prescribed for the propulsion of the scooter. Thus, measures of differential performance could be recorded and evaluated as the subjects were prescribed tasks of lower difficulty to those of higher difficulty.

The other learning sequence utilized in the study involved the use of projectiles. This program was designed to involve the visual mechanism in fixating and tracking of a projectile. Hierarchical functions were built into the programming with more elaborate ocular tracking behaviors associated with more intricate involvement of the posturing mechanism during task performance.

Each of these programs, enabled measured placement of each child at his specific level in seuqences of activities and the calculation of units gained in the acquisition of skill along the learning sequence was made for each subject. Thus, it was possible to compare the concomitant effects of gains in the visual motor skills learning sequence with the progress or lack of progress as measured by pre and post testing on the Beery Visual Motor Integration copy of design test.

RESULTS

The Wilcoxon Rank Sum Signed Ranks Test (Wilcoxon and Wilcoxon 1964) was used to determine differences between the five and ten year old groups of children with visual motor disabilities on the difference on pre and post tests on the copy of designs test and units gained in all of the visual motor herarchical learning sequences.

The differences between the number of designs mastered to criterion on pre and post testing was computed for each subject of each group. The Wilcoxon procedures was then applied to assess differences between groups. The number of units gained in each learning sequence by each subject was computed by determination of the difference between initial placement testing before program implementation and post testing to determine the termination placement in the learning sequences. The Wilcoxon procedure was then applied.

The data indicates that when the five-year-old group was compared to the ten-year-old group of children with visual motor disability for gains on the Visual Motor Integration Test, there was a significant difference at the .10 level in favor of the 5 yr. old group.

When the five-year-old and ten-year-old children with visual motor disability were compared on the amount of learning gains in the visual motor learning sequences, the ten-year-old group made statistically greater gains than the five-year-old group in all motor programs at the .10 level of confidence. See Table no. 1. The differences in the amounts of gains between groups were similar in all visual motor training programs.

Table No. 1

A comparison between 5 yr. and 10 yr. old children with visual motor disability on gains of copy of designs test and visual motor learning sequences.

	Copy of Designs	Kin. Motor Awareness	Balance Static	Balance Dynamic	Hand Eye	Total Program Gains
5 yr. olds	50.5*	97	88	89.5	89	100
10 yr. olds	85.5	39*	48*	46.5*	47*	36*

* .10 level of confidence (52, 84)

DISCUSSION

The findings of this study indicate 10-year-old children with visual motor disability learn perceptual motor tasks at a faster rate than 5 year-old children with visual motor learning disability. On the other hand, the data revealed that the 5-year-old group acquired greater skill on the cognitive task of copy of designs than the 10-year-old children.

These results should be interpreted with caution for the following reasons:

1. The sequential activities of the learning hierarchies were of ordinal measurement. Thus, the increment of step size from one activity to the next in the sequence is unknown, and the representation of a units gained indicate difference of amounts of learning, depending upon the segment of the program where performance occurs.
2. The measure of designs copied to a pass criterion on the Beery Visual Motor integration test involves ordinal measurement. Thus, the amount of prerequisite behavior acquired to enable mastery on a task which was not passed on the pre-test is unknown.
3. Personnel who implements the IPI System are trained in specific skills in conducting the programs, and the skills vary from one implementer to another.

This study suggests that the acquisition of specific types of motor activity does not necessarily have positive effects on the acquisition of cognitive tasks such as the ability to copy designs for all children with visual motor disability.

There are indications that specific types of activities contribute to specific visual motor subsystems at specific periods during development and may generalize greater to academic tasks. (Getman, 1965) Thus, a tenable hypothesis to account for the older group learning activities at faster rates than the 5-year-old groups of children with visual motor disability might be that the 10-year-old group had the prerequisite abilities to generalize abilities to task of the program and learned each activity as a specific task which would facilitate learning the skills. Thus, the tasks learned under these conditions by the 10-year-old group may have been more specific in nature and possess reduced capability to generalize to other areas of development. Klesius (1971) suggests that programs given after the critical period of development have less relevance to the beneficial effects of such programming in transfer to cognitive tasks.

Kleishman, 1964 and Kephart, 1965 express the notion of skill vs. ability structure. Skills according to (Fleishman, 1964) are learned fairly quickly, ability traits more slowly. Abilities tend then to generalize, while "splinter skills", bear little relationship to the learning of other tasks.

In this study, the balancing mechanism became operative when there was muscular innervation in a right and left direction to maintain equilibrium. Such movement is purported to be a prerequisite to efficient utilization of the visual processes (Kephart, 1961). Acquisition of this trait may not have been sufficiently developed in the five year old group. The tasks of the programs may develop the general abilities purported by the activities or the tasks may be learned as specific skills in themselves and possess little generalizing effects. Thus, the question of generalizability and specificity of tasks in the programming may be raised. Some pertinent questions which need to be answered from the study of the available data in relationship to hypothesizing practical programming in perceptual motor areas for children with visual motor disability are:

1) What activities contribute to specific ability structures which will enable generalization to cognitive areas.
2) Where is the point in development when experiences are such that they enable the emergence of the ability trait to transfer to concomitant cognitive areas.
3) Where is the point in development where activities are learned as specified skills and contribute to a lesser degree in the emergence of the structures which generalize to cognitive areas.

Answers to these questions appear to be pertinent to interpretation of these data. It might be hypothesized that once prerequisite levels of development on ability traits of visual motor subsystems have been reached, further development of the subsystems may have lessened effect on the generalizability to the cognitive aspects of performance and the motor activity tends to be learned as a specific skill.

Many parameters of visual motor development have been identified (Kephart 1961, Barsh 1967, Getman 1965) by those who have promoted the perceptual motor training to enhance visual motor development. There has been some acceptance that each parameter develops differentially from one another, yet is interconnected to visual motor functioning the total organism (Getman 1965). Thus, if prerequisites of a visual motor subsystem were achieved by the 10 year old group, it might be hypothesized that prerequisites were established for learning the tasks as specific skills and with lessened transfer effects to the cognitive tasks of copy designs. Thus, the motor gains would be more rapid for the older group, but the activity less significant than for the 5-year-old group because it was associated with an emerging visual motor subsystem at particular period of development which possessed greater transfer capability.

Further speculation as to the discrepancy between concomitant motor gains and ability to copy designs between the 5 and 10-year-old group might be in the nature of the selection of programs for specific learners within each group. Getman (1965) suggests a hierarchy of visual motor subsystems in which one visual motor subsystem gives rise to another. Such a hierarchy would suggest activities which are associated with individual developmental levels with respect to visual motor subsystems.

The study points to the need for selection of specific programming to be matched to specifically diagnosed emerging visual motor subsystems for each child for productive transfer to occur to cognitive areas. The current investigation did not consider the differential selection of programming based on emerging hierarchical visual motor subsystems. A further hypothesis that one might generate from the study is that children who function at lower levels of visual motor development can benefit from programming which is primarily of an interoceptive nature, while children at higher levels of visual motor development need programming more heavily loaded in exteroceptive ocular motor content. The programming in this study was able to account for visual-motor needs in each hierarchical learning sequence, but not in terms of differential hierarchical learning sequences matched to hierarchical subsystems for each child. All children received the same learning sequences. Most of the porgramming was concerned with body activities which involved primarily the interoceptors. This may have met the developmental needs of the younger group more so than the older group, who may have been in need of programming which involved greater ocular motor content.

CONCLUSIONS

The following conclusions are made from the exploratory study of the concomitant effects of the acquisition of skill in visual motor training programs and the ability to copy designs between differential age groups.

1) The concomitant effects of visual motor training on the ability to copy designs is not specifically related to mastery of visual motor tasks per se.

2) The concomitant effects of acquisition of skill in visual motor training on the ability to copy designs may be related to contributing to an emerging visual developmental sub-structure which facilitates the generalizability for greater ability in the copy of designs.

3) There is a need to plan differential learning sequence which relate specifically to deficient aspects of the copy of designs for specific children with specific ability structures.

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WORKSHOP PARTICIPANT SCHEDULE

TANO

Wednesday, August 20 -- 9:00 - 11:15 AM - Western State School & Hospital
Planning goals for the handicapped

Friday, August 22 -- 1:30 - 3:05 PM - Slippery Rock State College
6:15 - 7:50 PM - Relating assessment instruments to programming.

HAWKINS

Thursday, August 20 -- 8:30 - 10:05 Am-S.R.S.C. (Contingency mangement programs for L.D. Children)
1:00 - 3:15 PM -- Western State Hospital (Learning Principles and the low functioning for the Profoundly Mentally retarded)

Friday, August 21 -- 3:15 - 4:50 pm -- Learning principles for low functioning children
Slippery Rock State College

MILLER:

Wednesday, August 20 --1:00 - 3:15 PM -- Western State (Parent Training).
7:45 - 9:15 PM -- ITPA - Slippery Rock State College

Saturday, August 23 -- 1:00 - 2:35 PM -- Parent Training - Slippery Rock State College

REDDINGER:

Wednesday, August 20 -- 9:00 - 11:30 AM - Assessing instructional capability (1/2 with Western State School & Hospital (Joanne Miller

Saturday, August 23 -- 8:30 - 10:05 AM - Assessing instructional capability.
Slippery Rock State College

MC CANDLESS:

Thursday, August 21 -- 9:00 - 11:15 AM -- Western State Hospital

Saturday, August 23 -- 10:15 - 11:50 -- Slippery Rock State College

SCHEDULE

Fri., August 22:

1:00 - 1:30	Coffee Hour
1:30 - 3:05	Developmental goal planning for low functioning children of the young and developmental programming. (Auxter and Tano)
3:15 - 4:50	Task analysis for development of self-help skills. (Ihlenfeld)
6:15 - 7:50	Application of learning principles to programming. (Hawkins)
8:00 - 9:35	Relating assessment instruments to programming. (Tano)

Sat., August 23:

8:30 - 10:05	The assessing instructional capability of children. (Pat Reddinger)
10:15 - 11:50	The facilitation and inhibition of pattern reflexes. (McCandless, Physical Therapist)
1:00 - 2:35	Parent training. (Miller)
2:45 - 4:20	The profoundly retarded in the community. (Bensy)

SCHEDULE

Wed., August 20:

8:30 - 10:05	Defining objectives from visual motor ability structures. Baluikas, (Allegheny School for Exceptional Children).
10:15 - 11:50	Programmed instruction and the process of visual motor development. Auxter.
11:50 - 1:00	Lunch
1:00 - 2:35	Assessment of the motor functioning and programming. Ludwick, (Teaching Fellowship, S.R.S.C.)
2:45 - 4:20	Individualization through a self-instructional, self-evaluative instructional system. Ludwick.
6:00 - 7:35	Illinois Test of Psycholinguistic Ability (Staff)
7:45 - 9:15	The relationship of motor programming to visual motor integration of symbols. Miller, (Teaching Fellowship, S.R.S.C.)

Thurs., August 21:

8:30 -10:05	Application of learning principles and the implementation of programming. Hawkins, (Teaching Fellowship U.S.O.E. B.E.H. Programs for the Handicapped, Ohio State University)
10:20 -11:55	Visual motor development programs in the community. Elberti (Supervisor of Elementary Physical Education, Sharon, Pa.).