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Handedness and Dominance Patterns of Normal and Mentally Retarded Children

Robert Henry Schreindl
Central Washington University

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HANDEDNESS AND DOMINANCE PATTERNS OF NORMAL AND MENTALLY RETARDED CHILDREN

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Robert Henry Schreindl

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Dohn A. Miller, COMMITTEE CHAIRMAN

_____

Darwin J. Goodey

_____

John A. Schwenker

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CHAPTER I

INTRODUCTION

The awareness of left and right has existed a long time. Since the use of symbols, language has had direction. The English language is written from left to right. Before a child is taught to read he is shown the left to right ordering of letter symbols and the sounds for the symbols.

In the Arabic numbering system counting is from left to right. Adding, subtracting, and multiplying are right to left operations while division is a left to right operation. Awareness to the directions of these four fundamental operations in arithmetic is essential in developing subsequent mathematical concepts.

There has been a predominance of the population using the right hand for the left to right movement of writing and arithmetic, and most educators, until recent years, trained all youngsters to use the right hand for the left to right movements. This meant the children showing preference for the left hand were changed to use the right. Those not able to adjust did not make "normal" progress and often dropped out of school. Not much concern was given to the relationship between the ear, eye, or foot preferred and the performance of the left to right movements.

In the past there was not much known about the children that could not "keep up with the group," and not much was known about what they could do and what could be done for them. They were considered to be mentally retarded to some degree and dropped out of school.

The child develops preference or dominant use of one hand for the left to right movements of writing and arithmetic and he also develops dominant use of one eye and one foot for controlled movements. Observing these dominances provides some indication of development of the child. The present concern is to provide for achievement to fullest possible development of all individuals. For this it is necessary to know something about the development of individuals and how this relates to mental ability.

I. PURPOSE OF THE STUDY

In order to achieve this all-inclusive purpose of education for all children it is necessary to provide special education programs and services. Therefore, it is also necessary to find ways to distinguish children with learning problems to be placed in the special programs and services. The purpose of the investigation is to find possible correlations between hand dominance, laterality, and mental ability.

II. STATEMENT OF THE PROBLEM

The problem is to determine if left handedness differs significantly between normal and mentally retarded children, if laterality differs significantly between normal and mentally retarded children, and if laterality differs significantly between left and right handed normal and mentally retarded children.

III. IMPORTANCE OF THE STUDY

Does general dominance distinguish or help the classroom teacher to determine power of learning? If there is a positive correlation, this would be helpful in identification of youngsters with learning problems.

A review of the literature (Robbins, 1965) indicates that while the popular media have generally been favorable toward the theory of neurological organization, writers from the professions of medicine, psychology, and reading have not shared this enthusiasm. The literature also reveals a lack of published empirical studies testing hypotheses deduced from this theory (13:517-518).

Belmont and Birch (1965) found no reliable difference in lateral dominance between a group of retarded readers and a group of normal controls. The amount of mixed laterality among the retarded readers was not distinguishable from the degree of mixed laterality found in normal readers (2:70-71).

Brock (1957) states that only the eyes of all paired organs, can be less usable in joined action than in single use. The eyes cannot be kept in perfect balance without volitional effort. When the two eyes are literally at war with each other, fighting for supremacy which neither can achieve, the person is worse off than another having one eye or the other alone in their ability to read (5:504).

These illustrate the importance of the present problem to distinguishing children with learning problems.

IV. DEFINITION OF TERMS

Dominance. Preferred use of a particular eye, hand, or foot for finely controlled movements.

One sided or lateral. Same side dominance of eye, hand, and foot (LLL or RRR).

Mixed dominance. Both side dominance among eye, hand, and foot (LRL, LLR, and others).

Normal. (90 and above IQ) Average intellectual functioning for children their age.

Slow learner. (75 to 89 IQ) Below average intellectual functioning for children their age, but they do well enough that they are not thought of as being significantly deficient or incapable of learning in the school situation.

Mentally retarded. (50 to 74 IQ) Significantly sub-average intellectual functioning which manifests itself during the developmental period (the first sixteen years of life) and is characterized by inadequacy in adaptive behavior.

Severely mentally retarded. (Less than 50 IQ) Non-educable in the academic sense and unable to profit academically from participation in either the regular public school program, or in special classes designed for the educable mentally retarded.

The operational definitions of intellectual functioning refer to level of present intellectual functioning and the current status of the individual's adaptive behavior.

V. DELIMITATIONS OF THE STUDY

The study was conducted in Walla Walla, Washington. It was limited to include normal and mentally retarded children. Mentally retarded is defined 50-74 IQ and normal is defined as 90 IQ and above.

The operational definition of mentally retarded limits the significantly sub-average intellectual functioning to occur within the first sixteen years of life; therefore, the children included in the study were sixteen years of age or less.

Based on the nature of the study, survey required by teachers of the children, the sampling desired, and the class

scheduling in the district, the survey was limited, by the assistant superintendent to one fourth, one fifth, one sixth, and all the achievement (classes for educable mentally retarded) rooms of Jefferson, Paine, and Washington Elementary Schools. Then the age of the children was limited to 6-16 years. The writer's class at Jefferson School was excluded.

VI. SUMMARY

The awareness of left and right and a predominance of the population using the right hand for the left to right movement of writing and arithmetic has existed a long time. Until recent years, children showing a preference for the left hand were forced to use their right hand. Present concern is to provide for achievement to the fullest possible development of all individuals. To do this special education programs and services and ways to distinguish children with learning problems are necessary.

The problem is a survey of dominant eye, hand, and foot usage of normal and mentally retarded children to find the correlations between hand dominance, laterality, and mental ability. A review of the literature by Robbins (1965), Belmont and Birch (1965), and Brock (1957) illustrate the importance of this problem in identification of youngsters with learning problems.

The writer of this study sets forth the following hypotheses:

1. Left handedness does not significantly differ between normal and mentally retarded children.
2. Laterality does not significantly differ between normal and mentally retarded children.
3. Laterality does not significantly differ between left- and right-handed normal and mentally retarded children.

VII. OVERVIEW

Chapter II is a review of research relating to correlations of achievement and dominance. Chapter III is the procedure for this study. Chapter IV is the presentation and analysis of data. Chapter V is the discussion and summary.

CHAPTER II

INVESTIGATION OF RESEARCH

The purpose is to review the literature relating to correlations of mental ability and dominance.

Karlin and Strazulla (1952) note that a distinctive attribute of the human brain is the dominance of one cerebral hemisphere over the other in the performance of language function. This is in some way related to laterality, and especially to handedness, since in a right-handed person the speech areas in the brain are situated in the left or dominant cerebral hemisphere. Nielson (1946) states that the major and minor sides of the brain are differentiated on the basis of handedness and language.

Bauer and Wepman (1955) report that Hildreth, Koch, and Durost, using the Koch index of dominance, found cerebral dominance unique to the left hemisphere. Eason and others (1967), comparing responses to flash stimuli and handedness, concluded the differential amplitude of the responses of the two occipital lobes is related to handedness and that handedness cannot be predicted with certainty on the basis of observed lobe differences.

Goldstein (1948) notes that the development of dominance of one hemisphere seems to parallel the development of higher mental functions and the differentiation in the

use of hands begins at the same time. McCarthy (1947) states that lateral dominance apparently becomes established toward the end of the first year, and during the first months of the second year of life, which is just the period when speech begins to emerge from the infant's early babbling (10:288-289).

In investigations of handedness and mental deficiency, Anneliese Leiser-Eggert (1954) found no significant differences with regard to handedness between any two groups of children from kindergarten, elementary schools, special classes for children of subnormal intelligence, and children with emotional problems. Age, sex, intelligence, and psychiatric condition were not found to be related to dominance of eye, hand, or foot (11:5638).

Gordon (1921) found 7.3 per cent left-handed normal children and 18.2 per cent left-handed mental defective children. In a study of mentally retarded children by Karlin and Strazulla (1952) sixteen per cent were left handed. The findings were correlated with the intelligence quotients as established by psychological tests and a definite relationship was indicated between the establishment of handedness and the degree of mental retardation (10:288-289).

According to Bird (1967) Doman and Delacato believe the main idea is that the nervous system of each human being must go through a definite series of developmental stages before the brain can operate at its full potential. This

means, at birth only the lower part of the brain has been organized. The baby has only reflex actions controlled by the spinal cord and medulla. As the baby develops, the higher parts of the brain come into operation--pons, midbrain, and last, the cortex. The process is something like programming a blank computer in that the baby "programs" his motor-perceptual equipment, his nerves and brain cells, by trial and error, using his whole body and all of his senses. He "learns" by stages, trying motions, feeling things, testing them, hearing them, and looking at them. If a child misses any phase in the developmental sequence because of brain injury or lack of opportunity, then inadequate development at higher levels is likely.

The last and highest step in a child's neurological development is the development of laterality, or one sidedness. This occurs when a child begins to use one eye, hand, or foot in preference to the other for finely controlled movements. A basic principle of this concept is that a child cannot realize his full potential in receptive and expressive abilities until he develops complete one sidedness--that is, when his dominant ear, eye, hand, and foot are all on the same side (3:72-74).

I. SUMMARY

Karlin and Strazulla, Nielson, Bauer and Wepman, and Eason and others investigated cerebral dominance in relation

to handedness. Goldstein and McCarthy reported on the development of dominance. Anneliese Leiser-Eggert, Gordon, and Karlin and Strazulla compared handedness and mental ability. Bird (1967) stated Delacato's neurological organization theory of development and the need to develop laterality.

CHAPTER III

PROCEDURES

The purpose of this chapter is to see what possible correlations between hand dominance, laterality, and mental ability exist for children of Walla Walla, Washington.

One test, the Telebinocular (card with hole in it), was selected for determining dominant eye. One test, the hand preferred for writing, was selected for determining dominant hand. One test, the foot preferred for kicking, was selected for determining dominant foot. The test for each dominance was selected on the basis of determination of dominance, objectivity of observations for dominance, ease of administration and recording in a group situation, and time required to observe and record the desired information (6:274-276).

A survey form was made and then given to teachers for recording the results of the dominance tests. This form also included their evaluation of mental ability. This survey incorporated the Telebinocular test, the hand writing test, and the kicking test. The survey form was distributed to three Elementary Schools in Walla Walla, Washington. The three middle grades were represented and all achievement rooms of the three schools were included except the researcher's room.

An explanation of the survey was given at each of the three schools. Written directions for administration of these tests were given. The teachers then administered the tests and recorded their findings on the survey form supplied by the researcher.

The samples evaluated as slow learner (neither normal nor mentally retarded), the samples lacking evaluation of mental ability or observed dominance data, and the samples with physical limitation were discarded. This was done because they did not fit the purpose of the study or they were incomplete.

I. SAMPLING

The total sample included three hundred twenty children, about five per cent of the Public School population in Walla Walla, Washington. Of these, one hundred sixty-three were normal and forty-three mentally retarded. Sixty-nine were slow learners--neither normal nor mentally retarded. Forty-five were not used, forty-three lacking evaluation of mental ability or observed dominance data and two having physical limitation to use of one eye, one hand, or one foot. This is shown in Table I.

Two hundred six samples met the specifications of the problem and were grouped by the conditions of handedness, laterality, and mental ability specified by the hypotheses and appear in Table II on page 15.

TABLE I

EVALUATION OF MENTAL ABILITY OF CHILDREN BY TEACHERS

Teacher	N	SL	MR	NU	Total
Mg	23	2	0	1	26
Mr	23	5	1	0	29
	14	7	0	6	27
	24	6	0	0	30
Tr	0	0	10	0	10
A	1	9	3	0	13
N	0	6	6	2	14
E	18	14	1	3	36
Mn	15	7	1	0	23
Re	25	7	0	0	32
Rn	0	2	9	0	11
Sto	20	2	0	1	23
Sta	0	2	12	0	14
Th	0	0	0	32	32
TOTAL	163	69	43	45	320

Key: N - Normal; SL - Slow Learner; MR - Mentally Retarded; NU - Not Used.

TABLE II

CHILDREN GROUPED BY CONDITIONS OF HANDEDNESS, LATERALITY, AND MENTAL ABILITY AS SPECIFIED BY THE HYPOTHESES

Hypothesis	Condition	Fraction	Per Cent
1	Left-handed mentally retarded	5/43	11.6
	Left-handed normal	15/163	9.2
2	Lateral mentally retarded	26/43	60.5
	Lateral normal	99/163	60.7
3	Lateral right-handed N & MR	122/186	65.6
	Lateral left-handed N & MR	3/20	15.0

II. METHOD OF ANALYZING DATA

To determine whether the findings are statistically significant, the Chi Square test with a fourfold contingency table as described by Van Dalen (14:408-412) was employed.

When the expected frequency for any cell of a Chi Square contingency table is less than five, the validity of the test is questionable. When this occurred, the Fisher Exact Probability Test as described by Fisher (8) was also used. The Chi Square test was used to determine the significance in terms of the probability the observed proportion was a chance departure from the expected proportion and the Fisher Exact Probability Test was used to determine the probability that the observed proportion occurred by chance.

CHAPTER IV

RESULTS, SUMMARY, AND RECOMMENDATIONS

This chapter will contain the results, summary, and recommendations of the researcher. The results of the calculated Chi Square and Fisher Exact Probability tests and significant Chi Square values for the five per cent and the one per cent levels, as shown in Table III will be discussed.

I. RESULTS

Between left-handed normal and mentally retarded children, the resulting Chi Square (0.22), with 1 df, (Degrees of Freedom), is smaller than that required at the five per cent (3.84) and the one per cent (6.64) levels and a Fisher P value of 0.20, so the null hypothesis that left handedness does not significantly differ between normal and mentally retarded children may be accepted.

Between lateral normal and mentally retarded children the resulting Chi Square (0.00) is smaller than that required for significance at the five per cent and the one per cent levels, so the null hypothesis that laterality does not significantly differ between normal and mentally retarded children may be accepted.

Between lateral right-handed and left-handed normal and mentally retarded children, the resulting Chi Square

TABLE III

RESULTS OF THE CALCULATED CHI SQUARE AND FISHER EXACT PROBABILITY TESTS AND SIGNIFICANT CHI SQUARE VALUES FOR THE FIVE PER CENT AND ONE PER CENT LEVELS

Hypothesis	Condition	df	Observed Chi Square	Significant Chi Square		Fisher P
				.05	.01	
1	Left-handed mentally retarded / Left-handed normal	1	0.22	3.84	6.64	0.20
2	Lateral mentally retarded / Lateral normal	1	0.00	3.84	6.64	
3	Lateral right-handed N & MR / Lateral left-handed N & MR	1	16.56	3.84	6.64	0.0000125

(16.56) is larger than that required for significance at the five per cent and the one per cent levels, so the null hypothesis can be rejected and it may be concluded that significant laterality differences exist between right- and left-handed normal and mentally retarded children.

Discussion

Brock's statement (1957) on the importance of dominant vision in reading ability is reason to investigate dominance, especially if a child does not show a preferred use of an eye, hand, or foot for finely controlled movements by the age of six years.

Doman and Delacato (1967) stated that complete laterality was necessary before a child could realize his full potential in receptive and expressive abilities. In the present study a significant correlation between laterality and handedness was found. Handedness and laterality were not significantly related to mental ability. The present findings support Goldstein (1948) and Anneliese Leiser-Eggert (1952) and dispute Gordon (1921) and Karlin and Strazulla (1952).

It would appear that there is a close interdependence between the development of cerebral dominance, laterality, especially handedness, and mental ability. One may postulate that the dominance of one cerebral hemisphere is the primary

condition which influences the development of laterality. It is also possible that laterality results in the preference of one side of the body, usually the right side, and this causes a richer flow of sensory impulses to the opposite cerebral hemisphere and is a factor in establishing cerebral dominance. The best that can be said is that cerebral dominance and handedness are processes that are interrelated and influence one another developmentally.

Modern science has deeply investigated the human brain, charting its structure, chemistry and functions, but nobody knows exactly how the brain works, how it learns. Most of the work here is theory.

II. SUMMARY

The awareness of left and right and a predominance of the population using the right hand for the left to right movement of writing and arithmetic has existed a long time. Until recent years, children showing a preference for the left hand were forced to use their right hand. Present concern is to provide for achievement to the fullest possible development of all individuals. To do this special education programs and services and ways to distinguish children with learning problems are necessary.

A survey of dominant eye, hand, and foot usage of normal and mentally retarded children to find possible

correlations between hand dominance, laterality, and mental ability was made.

Brock (1957) reporting dominant vision relating to reading ability, Belmont and Birch (1965) finding no significant difference between dominance patterns and mental ability, and Robbins (1965) revealing a lack of published empirical studies testing hypotheses of the neurological development theory illustrate the importance of the present problem to distinguishing children with learning problems.

Karlin and Strazulla, Nielson, Bauer and Wepman, and Eason and others investigated cerebral dominance in relation to handedness. Goldstein and McCarthy reported on the development of dominance Anneliese Leiser-Eggert, Gordon, and Karlin and Strazulla compared handedness and mental ability. Bird (1967) stated Delacato's neurological organization theory of development and the need to develop laterality.

The writer was allowed one fourth, one fifth, one sixth, and all achievement (classes for educable mentally retarded) rooms at Jefferson, Paine, and Washington Elementary Schools in Walla Walla, Washington. The writer's achievement class at Jefferson School was excluded from this study.

Tests for dominance and design of the survey form were selected by the writer on the basis of determination of dominance, objectivity of observation for dominance, ease of

administration and recording in a group situation, and the time required to observe and record the desired information on the survey form. Evaluation and observation was left to the classroom teacher.

The total sample included three hundred twenty children, about five per cent of the Public School population. Of these, one hundred sixty-three were normal, forty-three were mentally retarded, and forty-five were not used because of missing data or physical limitation. Two hundred six samples met the specifications of the problem.

To determine whether the findings were statistically significant, the Chi Square and Fisher Exact Probability Tests were used. The null hypothesis that left handedness does not significantly differ between normal and mentally retarded children was accepted. The null hypothesis that laterality does not significantly differ between normal and mentally retarded children was accepted. It was concluded that significant laterality differences exist between right- and left-handed normal and mentally retarded children and that there is a positive correlation between laterality and handedness.

Handedness and laterality were not significantly related to mental ability. This supports Goldstein (1948) and Annelies Leiser-Eggert (1948) and disputes Gordon (1921) and Karlin and Strazulla (1952).

It would appear that there is a close interdependence between the development of cerebral dominance, laterality, especially handedness, and mental ability. The best that can be said is that cerebral dominance and handedness are processes that are interrelated and influence one another developmentally.

Modern science has deeply investigated the human brain, charting its sturcture, chemistry and functions, but nobody of this earth knows exactly how the brain works, how it learns.

III. RECOMMENDATIONS

From the findings of this study the classroom teacher need not be concerned with dominance patterns to distinguish learning problems of children because no significant correlation between handedness and mental ability and no significant correlation between laterality and mental ability was found.

Because of the different criteria used for determining dominance and the conflicting results reported, the next researcher might repeat this study or investigate the problem further with other criteria for determining dominance.

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APPENDICES

APPENDIX A

SURVEY INSTRUCTIONS

I. List the names of the children in your class with their first name first in the space provided. (You may list them alphabetically, but this is not required.)

II. Indicate the sex of each child by writing the letter M or F in the space provided.

III. Evaluate each child as normal (N), slow learner (SL), or mentally retarded (MR) using the following operational definitions and write in the letter(s) in the space provided.

Normal - (90 and above IQ) average intellectual functioning for children their age.

Slow learner - (75 to 89 IQ) below average intellectual functioning for children their age, but they do well enough that they are not thought of as being significantly deficient or incapable of learning in the school situation.

Mentally retarded - (50 to 74 IQ) below average intellectual functioning which manifests itself during the developmental period (the first sixteen years of life) and is characterized by inadequacy in adaptive behavior.

IV. Dominance

Eye - have each child use the card and view a penny through the hole in the card with both eyes, holding the card at arm's length. While continuing to view the penny the subject raises the card to his nose. When the card touches the nose, the eye having the hole over it is dominant. Observe only one trial, the first one, and indicate the dominant eye by writing L or R in the space provided.
The cards were originally cut five inches square and the hole centered for this size. To punch out the hole cleanly, the cards were cut to four inches square and the hole ended up off center.

Hand - indicate the hand each child uses to write with by writing L or R in the space provided (one observation).

Foot - indicate the foot each child uses to kick with by writing L or R in the space provided (one observation). For observing kicking use a round ball and

the game of kickball or distance kicking competition.

Your help in conducting this survey is appreciated.

APPENDIX B

SURVEY FORM

Handedness and Dominance Patterns of Normal and Mentally Retarded Children

Name	Sex M - F	Mental Ability N SL MR	Eye Dominant L or R	Hand Writing L or R	Foot Kicking L or R
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					

APPENDIX C

EYE DOMINANCE OBSERVATION CARD