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ABSTRACT

Eighteen first grade children (10 boys and eight girls, IQ's 91 to 128) who evidenced a developmental deficit on the Sapir Developmental Scale were placed in one of two groups. Twelve children in an experimental group compromised a self contained class and were given deficit centered training. The six in the control group were placed with 12 children without problems and given the traditional curriculum without deficit centered training. In the deficit centered program emphasis was placed on sensory stimulation in a carefully planned environment. The experimental group did significantly better on many, but not all of the intellectual, perceptual, and language tests; but data on academic achievement failed to show significant differences. Two factors are noted which might have contributed to the results: children who develop unevenly may have a distinctive learning pattern and process information differently, and neurological impairment could have a negative effect on academic performance regardless of WISC IQ. These factors and questions raised by the study are discussed. (RJ)

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Research Report

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ABSTRACT

The development of a deficit centered training curriculum to prevent learning disability is described. Developmentally deficit youngsters were placed in one of two groups, one of which received the deficit centered training, the other a traditional curriculum. The results of such an intervention program as they related to developmental and academic growth are studied. Questioned are some of the current trends in education as the youngsters fared equally well academically in both the experimental and control groups.

LEARNING DISABILITY AND DEFICIT CENTERED CLASSROOM TRAINING[1,2]

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A review of the literature suggests that there are from 7 to 25% of all children in trouble academically in our schools (Bender, 1968; DeHirsch, 1966; Silver & Hagin, 1968). Reasons for this are multi-faceted and include emotional disorder, neurological dysfunction, environmental stress, developmental lags and genetic factors. Intervention programs to train deficit areas are suggested but the value of such programs have not been substantiated by research. Methodology for such programs has been suggested by the following theoretical positions: bodily and spatial schema is significantly related to later orientation to the environment (Kephart, 1960); the perceptual-motor development of the child is related to academic success (Birch, 1964; Cruickshank, 1961; Frostig, 1965; Silver & Hagin, 1965); language is the medium by which the child comprehends his world and it acts as a mediator in learning (Luria, 1961); differential diagnosis is possible and specific learning techniques can be developed to alleviate the deficits (Kirk & McCarthy, 1961; Rabinovitch, 1956; Frostig, 1965); it is possible to reorganize, reeducate and reintegrate where perceptual and language problems are present (Bruner, 1957).

The research reported here had three major goals: the development of an effective instrument to identify developmental problems at age five, the development of a "deficit

centered" training curriculum, and the evaluation of the effectiveness of this curriculum by measuring the child's developmental growth and academic achievement before and after the intervention program. It was hypothesized that the performance of the experimental subjects would be significantly higher than that of the control subjects in intelligence, bodily schema, perceptual-motor skill, language development and academic achievement after the intervention program.

METHOD

Subjects

Ss were eighteen children, ten boys and eight girls selected from a total first grade population of fifty-four children, thirty-six girls and eighteen boys, attending a primary public school in a high socio-economic suburban community. The eighteen children evidenced a developmental deficit on the Sapir Developmental Scale (Sapir & Wilson, 1967). The scale measures bodily schema, perceptual-motor skills and language development and consists of 10 subtests as follow: Visual Discrimination, Visual Memory, Auditory Discrimination, Auditory Memory, Visual-Motor, Visual-Motor Spatial Relationships, Body Image, Directionality-Laterality, Orientation in Language and Vocabulary (Sapir & Wilson, 1967). The scale has a range of score from 0 to 100 and those children who score below 60 and manifested difficulty in two of the three areas were considered "deficit." The children were aged 5-9 to 6-7 at the beginning of first grade. The two oldest were girls and the two youngest were boys. The study of the screening instrument

revealed sex differences on these tasks (Sapir, 1966) with girls maturing well ahead of boys. The older girls present different and more severe problems than the younger boys. The children were of average or better IQ (range from 91 to 128) and the differences in cultural and economic background were minimal.

Design

These eighteen children were placed in one of two groups. Twelve (seven boys and five girls) children in the experimental groups constituted one self contained class which was given "deficit centered" training. The remaining six children (three boys and three girls) in the control group were placed with twelve children without problems in a class given the traditional curriculum without "deficit centered" training. The experimental and control groups were matched as closely as possible by score on the Sapir Developmental Scale (experimental group mean 46.5, control group mean 47.5), chronological age (experimental group mean 6-1, control group mean 6-2) and sex (experimental group seven boys and five girls, control group three boys and three girls).

Two teachers, one for each group, were experienced and each in their second year at this school. The teachers cooperated in the study by having observers in the classroom, giving group tests and keeping careful records. They recorded curriculum covered and materials used for each two month period. An impartial observer recorded a day's program every six weeks so that one could be sure the teachers taught what they said they did. To counterbalance the resource persons (psychologist

and curriculum consultant) involved with the experimental group, the reading teacher worked with the teacher of the control group. The small number of children used as subjects was a compromise imposed by the number of such students in this school at this grade level.

Deficit Centered Training Program

An assumption was made that children needed sensory stimulation in a carefully planned environment. Hence the children should be helped to efficiently organize, categorize and integrate these stimuli so that they could become symbolized and readily available. The classroom itself, including the furniture and the people in it, was seen as the setting to help the child orient himself, distinguish figure from ground, assimilate and integrate the simultaneous and sequential sensory input. The placement of the materials all had purpose and was strategic to learning. For example, as each word was taught, it was placed with matching picture on a bulletin board so that it could be used by the children as their clue in independent written work.

Training in perceptual-motor and language readiness was seen as necessary to help the child progress from the sensorimotor stage characterized by unstable attention and distractability to the more advanced stage of visual imagery characterized by more attentional control. Training a child in body work was seen as a prerequisite to organizing the perceptual field around his own person. The child was taught left-rightness and spatial orientation to help him understand his relationship to the environment and help

stabilize the visual stimuli. Language training included the organization of thought processes through a conceptual framework of classifying, analyzing and synthesizing. Reading instruction was not delayed while such multifaceted training took place; rather the reading instruction was used to stimulate perceptual and cognitive integrative functioning.

Deficit children do not constitute a homogeneous group in the nature or extent of their deficits (Sapir & Wilson, 1967). For evaluation purposes an intensive testing program of intellegence, bodily schema, perceptual-motor skills and language development was planned before and after the intervention. For those children in the experimental group, graphs of each child's strengths and weaknesses were presented to the teachers. Along with graphs, training techniques for each area tested were presented so that, for example, if a child had a deficit in bodily schema, the child was offered training in bodily movement through clapping, marching, tapping in imitative movement, then later taught from auditory clues rather than movement and later from visual clues alone. Finally he was asked to translate the auditory or visual clue to rhythmic movement on paper.

Training was offered in directionality by requiring the children to copy positioning with other children acting as models, first facing in same direction, then facing in reversed position, then using "standpatters" (little flexible dolls) as models for the children instead of their own bodies. The children moved from the concrete to the imitation of the two dimensional picture from storybooks.

In the perceptual-motor area, children were trained with the use of pegboards, parquetry blocks, sand trays, cubes and felt. They copied patterns from concrete forms, then pictures and lastly from memory. Verbal mediation was encouraged so that if they were copying a pegboard design, the children were encouraged to verbalize the stimulus they saw and say where they were to place the pegs.

In order to simulate dot-dash patterns (auditory-visual integration) words such as walk-run were used. Auditory sequencing was taught through the use of children's phone numbers exchanged so that they could telephone each other after school. Objects were hidden in a box which children felt through a peep hole. The child was encouraged to tell what the object felt like, describe it in terms of class designation (fruit, vegetable, clothing, etc.) and have the other children guess what it was. It was hoped that the children would learn to match visual, auditory, tactile responses and thus make their perceptions more predictable.

A linguistic approach was used in language arts. Each letter and number was coded by color, number of spaces and direction of writing. Once taught, the letter or number with appropriate picture became a visual clue as it was placed on display in the room. Each letter was associated to meaningful content (a for apple, b for boy, etc.). All letters of two spaces were differently color coded and those that were 1-2 space letters (b,d,f) were separated from the 2-3 space letters (g,j,p). All sensory modalities were used to teach the letters and numbers. Reading proceeded from letters to words.

Only words that carried the grapheme-phoneme correspondence were used, such as fat, dig, met. Children were made aware of the discrete differences within words and how they relate to sounds and to meaning. The program began with the analysis of the spoken word and proceeded to give the child insight into the structure of the written word, the sentence, the paragraph and the story. As the children learned more words, they were encouraged to create their own stories, writing them with words that were readily available to them through the visual displays in the room. The children shared the books they wrote.

The Catherine Stern Structural arithmetic program was combined with Montessori manipulative materials to teach arithmetic. The children were encouraged to use concrete materials, color coded.

Materials were individually organized for each child and each child had workbooks that had individual stencil sheets put together for him. Group work was also emphasized so that the children could learn to accept each others problems and help each other.

Traditional Curriculum for Control Groups

The Houghton-Mifflin developmental readers, stencils, charts and audio tapes were the basic reading program. The Spaulding Writing Road to Reading was introduced and the children were taught the 60 seconds of English. The Greater Cleveland mathematics program was used in arithmetic. Three to four hours each day was spent on reading and writing with very little free time or outdoor play.

Evaluation

The children were tested in the fall and spring of first grade before and after the intervention program. Intelligence, bodily schema, perceptual-motor skill, language ability and academic achievement were tested. In the spring of second grade children were retested academically. Intelligence was measured with the Wechsler Intellectual Scale for Children using all the subtests. Measure of bodily schema (the child's awareness of his own body in space) consisted of the Draw-A-Person Test with Goodenough Harris scoring (Harris, 1964), Harris Test of Laterality (Harris, 1957) and the Hawthorne Concepts Scale and its subtests (Rabinovitch, 1956). Perceptual-motor skill was evaluated with the Bender-Gestalt Visual Motor Test using Koppitz scoring (Koppitz, 1964), the Marianne Frostig Test of Visual Perception (Frostig, 1964) and the Auditory-Visual Integration Test (Birch, 1965). The Illinois Test of Psycholinguistic Ability (Kirk & McCarthy, 1961) was administered to evaluate language. The measurement of academic achievement presented a problem because the control group was taught a developmental whole word sight method using developmental readers, and the experimental group used a structual linguistic approach using only reading material that had a grapheme-phoneme correspondence. Because of this, two sets of reading tests were given at the end of first grade, - the Stanford Achievement Test Primary I (containing sight words) and the Structural Reading Tests Experimental Edition containing only words that had a grapheme-phoneme correspondence.

In the spring of second grade, the Stanford Achievement Test Primary II and the Gray Oral Reading Paragraphs were administered.

RESULTS

It was hypothesized that the performance of the experimental group would be significantly higher than that of the control group on each of the tested variables. The experimental group did significantly better on many, but not all of the intellectual, perceptual and language tests; but data on academic performance failed to show significant differences. Scores on the WISC indicated the following: significantly higher performance in the experimental group on total IQ score (U=15), Verbal IQ score (U=16 and subtests Comprehension (U=15), Vocabulary (U=9) and Object Assembly (U=16). There were no significant differences between the groups on the Performance IQ score and subtests Information, Arithmetic, Similarities, Picture Completion, Picture Arrangement, Block Design and Coding.

Table 2 reveals that the control group did significantly better than the experimental group on the Harris Test of Laterality (U=46) and on the Hawthorne Concepts Scale subtests Directionality (U=40) and Time (U=46). The experimental group performed significantly better only on the Hawthorne Concepts Subtest Writing (U=16) but there were no significant differences on the total score of the Hawthorne Concepts Scale and its subtests Information, Quantity and Dimension and Laterality. The Draw-A-Person Test revealed no significant differences in change between the two groups.

Table 3 reveals the amount of change in perceptual-motor development. The experimental group performed significantly better on the Birch Test of Auditory-Visual Integration (U=11), the total score of the Marianne Frostig Test of Visual Perception (U=11) and its subtests Figures-Ground (U=17) and Spatial Relationship (U=4). The subtests Eye-Hand Coordination, Perceptual Constancy and Position in Space of the Frostig showed no significant difference between groups. The Bender-Gestalt Visual Motor Test (U=18) failed to reach significant diffence but the direction of change favored the experimental group.

The change in the total score of the Illinois Test of Psycholinguistic Ability is shown in Table 4 with experimental group performing significantly better. (U=9). In the ITPA subtests, the experimental group changed significantly more than the control on Motor Encoding (U=15), Auditory-Vocal Association (U=8), Auditory-Vocal Sequencing (U=10) and Vocal Encoding (U=8). The remaining subtests of the ITPA, Visual Decoding, Visual-Motor Sequencing and Visual-Motor Association showed no significant differences.

Table 5 and 6 shows little significant difference between the experimental group and control group in academic performance in first and second grade. The experimental group did significantly better on the Vocabulary Subtest (U=14) of the Stanford Primary I Achievement Tests and the control group did significantly better on the Spelling Subtest (U=56) administered at the end of first grade. On the Structural Tests, administered at the same time, the experimental group performed significantly higher in initial and final sounds and the control group performed significantly better in Sight Words; but there was no

significant difference between the groups on the total score, Silent E Word subtest and Reading Paragraphs. By the end of second grade there were no significant differences in academic performance between the two groups on the Gray Oral Reading Paragraphs or the Stanford Achievement Tests Primary II and its subtests.

DISCUSSION

The results of the present study indicate that significantly more growth took place intellectually, perceptually and in language skill in the experimental group than the control but that this was not reflected in the academic performance. Since it has been suggested that the IQ is a good indicator of academic success (Thorndike & Hagen, 1961), one should be able to predict that a group of children with increasing intellectual function should perform better in reading, arithmetic and language arts. However, the present results do not bear this out.

Two confounding factors might have contributed to the results: (1) it might be that children who develop unevenly have a distinctive learning pattern and process information differently and, (2) neurological impairment in the study population could have a negative effect on academic performance regardless of the WISC IQ. The WISC may not tap cognitive skills required to learn reading and writing and arithmetic in children with neurological difficiencies. Most of the increase in the experimental group was in verbal IQ rather than performance. The "deficit centered" training program had little effect on the WISC performance subtests with the

exception of Object Assembly. The performance subtests of the WISC may be more related to the visual decoding process than the verbal IQ.

Neither the class size (when comparing 12 to 18 children) nor the nature of the program had significant effect on the achievement of the children. Differences in developmental and academic growth patterns tend to be a result of what is taught directly. For example, in the testing before the intervention program the children's performance on the Object Assembly Subtest of the WISC was well below the accepted norms. Much effort went into developing this skill in the experimental group through special Transgram puzzles. This may well explain the reason for so much growth in the experimental group on this task (experimental group, medium change 4.0; control group, medium change 1.0). The same principle may be in effect when we look at the Stanford Achievement Primary I results. The control group spent much time spelling and writing words and the experimental group developed vocabulary skills, with the control group performing significantly better in the spelling subtest of the Stanford Achievement Primary I, and the experimental group performing significantly better in the vocabulary subtest of both the WISC and the Stanford Achievement Primary I.

Twelve of the eighteen children performed at or above grade level in the spring of the second grade on the Stanford Achievement Tests. Eight (four boys and four girls) of the twelve were from the experimental group, and four (one boy and three girls) from the control group. Possible reasons for the success of the majority of subjects may be found in better teaching methodology, additional resource persons and a Hawthorne effect.

A blind neurological survey of the first grade population of this school was performed by Dr. Arnold Gold, Pediatric Neurologist of Columbia Presbyterian Hospital. Twenty-seven randomly selected children were seen by Dr. Gold in cooperation with the Nurse and Medical Service of the school. Thirteen of the twenty-seven randomly selected first grade youngsters were diagnosed to have "minimal cerebral dysfunction." The thirteen were among the eighteen of our study population. Of the remaining five, three were seen by Dr. Gold and rated as neurologically normal and two were not seen. The four children rated most deficient on the neurological examination were among the twelve who performed well academically. Conversely, the three children rated neurologically normal by Dr. Gold, were among the six who performed below grade level academically. Factors other than neurological involvement may be related to academic achievement in developmentally deficit children. To be considered are emotional factors and environmental stress in the family.

Boys in this study were more susceptible to problems than girls and their difficulties tended to persist. Boys have been found to lag in development on the task of the Sapir Developmental Scale (Sapir, 1966). It is not surprising that the boys represent 55% (10 out of 18) of the total male and girls 22% of the total female (8 out of 36) first grade population found to be developmentally deficit. The two oldest subjects were girls and the youngest boys. Considering that girls mature more rapidly than boys, it might suggest that these girls may have had more severe problems than the young boys who may have been immature. However, by the end of the second year, five boys (50% of the

study population) and seven girls (87.5% of the study population) performed up to grade level academically. The youngest boy diagnosed to have "frank brain damage" performed well academically at the end of second grade although he was one of the most difficult children to manage behaviorally.

This study places in question many educational principles currently prevalent in our schools: (1) the notion of expectancy in achievement based on mental ability scores, (2) the value of the segregated class for children with learning problems, (3) the deficit centered methodology or the perceptual approach.

Siegel (1968), discussing the current scientific aura which has gripped education, suggests educators seek answers with a vengeance. He suggests it is quite easy to fall into a trap of believing that a particular approach offers more than it is capable of delivering, and that learning disability proponents often carry their diagnostic remediation to an extreme, implying that there is a known remedy. Capobianco (1964) calls attention to the "new movement to establish special classes for children with similar learning disabilities" and suggests this methodology warrents close examination. This research agrees and questions the value of the special class and its assumption that children with similar learning disabilities learn best by being placed together.

Mann (1969) in a general statement on "Perceptual Motor Training: Misdirections and Redirections" questions the value of perceptual motor training programs of the Barsch-Kephart variety or Frostig Style small muscle visual-motor tasks. He

finds fault with all these approaches in that they translate abstractions from theory and experiment, at best substantiated only partly by empirical work, into concrete educational approaches. He suggests that the popular perceptual approaches assume that you can break global, motor behavior into discrete and distinct units of functioning to be exercised. This research indicts the perceptual movement for claiming that training in perception will, of and by itself, improve academic performance.

Growth in developmental patterns does help the child gain more adequate feelings about himself but there may be many ways to achieve similar results. Suggested is a clinical teaching methodology which emphasizes observations of children to make the teachers aware and sensitive to the child's performance and helps the teacher develop mastery in the skills of teaching the 3 R's via perceptual and cognitive approaches.

TABLE 1

Significance of Median Change in Intelligence

Between Experimental and Control Groups

Test	Experimental Group N=12 Median Change	Control Group N=6 Median Change	U***
WISC Total IQ	11	2	15*
WISC Verbal	7	-.5	16*
WISC Performance	9.5	2.5	24
WISC Information	1.5	2.5	35
WISC Comprehension	2.5	-.5	15*
WISC Arithmetic	.5	0	27
WISC Similarities	1.5	-.5	21
WISC Vocabulary	.5	-1.5	9**
WISC Picture Completion	.5	-1	19
WISC Picture Arrangement	2	-.5	21
WISC Block Design	-1	-1	23
WISC Object Assembly	4	1	16*
WISC Coding	.5	1.5	35

*Significant difference at .05 level favoring the experimental group

**Significant difference at .01 level favoring experimental group

***Mann-Whitney Non-Paremetric Statistic
Critical Value n_1=6 n_2=12 U=17 at .05 level
U=11 at .01 level

TABLE 2

Significance of Median Change in Bodily Schema

Between Experimental and Control Groups

Test	Experimental Group N=12 Median Change	Control Group N=6 Median Change	U**
Harris Test of Laterality	0	1	46***
Hawthorne Total	9	6.5	28
Hawthorne Information	1	2	32
Hawthorne Quantity and Dimension	1.5	0	26
Hawthorne Number	2	-.5	18
Hawthorne Directionality	1	1	40***
Hawthorne Writing	2	1	16*
Hawthorne Laterality	-.5	-.5	27
Hawthorne Time	1	2	46***
Draw A Person Test	5.5	1	27

*Significant difference at .05 level favoring the experimental group

**Mann-Whitney Non-Parametric statistic where critical value is U=17 at .05 level with n_1=6 and n_2=12

***Significant difference at .05 level favoring control group

TABLE 3

Significance of Median Change in Perceptual-Motor Skill Between Experimental and Control Groups

Test	Experimental Group N=12 Median Change	Control Group N=6 Median Change	U***
Bender-Gestalt Visual-Motor	5.5	3.5	18
Birch Auditory-Visual Integration	2	1	16*
Frostig Visual Perception	20.5	2.5	11**
Frostig Eye-hand	2.5	1	18
Figure-Ground	3	1	17*
Perceptual Constancy	1	-1	22
Position-in Space	2	3.5	27
Spatial Relationships	1	-.5	4**

*Significant difference at .05 level favoring experimental group

**Significant difference at .01 level favoring experimental group

***Mann-Whitney Non-parametric statistic where critical value is U=17 at .05 level and U=11 at +.01 level when n_1=6 and n_2=12

TABLE 4

Significance of Median Change in Language Development

Between Experimental and Control Groups

Test	Experimental Group N=12 Median Change	Control Group N=6 Median Change	U***
ITPA Total	1.71	-.015	9**
ITPA Visual Decoding	-.19	.32	40
ITPA Motor Encoding	.39	-.135	15*
ITPA Auditory Vocal Assn.	.985	-.05	8**
ITPA Visual Motor Sequencing	.39	.755	43
ITPA Vocal Encoding	1.17	-.325	8**
ITPA Auditory Vocal Sequencing	.725	.395	10**
ITPA Visual Motor Assn.	-.065	-.16	32

*Significant Difference at .05 level favoring experimental group

**Significant Difference at .01 level favoring experimental group

***Mann-Whitney Non-Parametric test where critical value is U=17 at .05 level U=11 at .01 level with n_1=6 and n_2=12

TABLE 5

Significance of Differences in Median Scores in

First Grade Achievement Tests

Between Experimental and Control Groups

Test	Experimental Group N=12 Median Change	Control Group N=6 Median Change	U****
Stanford Achievement Primary I Total	140.5	146	42
Stanford word meaning	19.5	19.5	33
Stanford paragraph meaning	12.5	19.5	51
Stanford vocabulary	23	19.5	14*
Stanford spelling	7	12.5	56***
Stanford Word Study	37	37.5	30
Stanford Arithmetic	39.5	38	31
Structural Reading Total	89.9	94.5	40
Struc. Reading Initial Sounds	25	25	10**
Struc. Reading Final Sounds	20	18	11**
Struc. Reading Sight Words	21	22	44***
Struc. Reading Silent E	11.5	11.5	29
Struc. Reading Initial Blends	13	16.5	37
Struc. Reading Paragraphs	57.5	52.5	19

*Significant differences at .05 level favoring experimental group

**Significant difference at .01 level favoring experimental group

***Significant difference at .05 level favoring control group

****Mann-Whitney Non-Parametric Test where critical value is U=17 at .05 level, U=11 at .01 level with n_1=6 and n_2=12

TABLE 6

Significance of Difference in Median Scores in Second Grade Achievement Tests Between Experimental and Control Groups

Test	Experimental Group N=12 Median Change	Control Group N=6 Median Change	U*
Stanford Achievement Primary II	146.5	186.5	47
Stanford Word Meaning	18.5	21	40
Stanford Paragraph Meaning	32	33.5	39
Stanford Spelling	7.5	13	45
Stanford Word Study	30	37	50
Stanford Language	29.5	36	50
Stanford Arithmetic Computation	14.5	20	46
Stanford Arithmetic Concepts	17.5	19	40
Gray Oral Reading Paragraphs	11	15	39

*Mann-Whitney Non-Parametric statistic where critical value is U=17 at .05 level and U=11 at .01 level with n_1=6 and n_2=12

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FOOTNOTES

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2. This paper is a follow-up study based on an earlier version presented at the annual convention of the Council for Exceptional Children at Denver, 1967. The original study was supported by Grant #6005 U.S. Office of Education and sponsored by Teachers College and Scarsdale Public Schools.

3. The author is presently a Project Associate at the Research & Demonstration Center for Handicapped Children, Teachers College, Columbia University, and wishes to thank Dr. Leonard Blackman, Dr. Ross Evans and Dr. Edith Levitt for their helpful criticism of the manuscript.

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