DOCUMENT RESUME

ED 347 723 EC 301 334

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TITLE Educational Implications for Agenesis of the Corpus Callosum.
PUB DATE 17 Apr 92
NOTE 18p.; Paper presented at the Annual Meeting of the Council for Exceptional Children (70th, Baltimore, April 13-17, 1992).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Case Studies; *Congenital Impairments; Foreign Countries; Intervention; Longitudinal Studies; *Mainstreaming; Mild Mental Retardation; *Neurological Impairments; *Neurology; Rural Education; Student Evaluation
IDENTIFIERS Australia

ABSTRACT

This case study evaluates the case of a 20-year-old young Australian adult born with agenesis of the corpus callosum, the area of the brain uniting the hemispheres. Deficits commonly associated with agenesis of the corpus callosum are mental retardation, motor involvement, seizure activity, and lateral transfer difficulties. The report: (1) identifies the types of collosal lesions, results of sectioning of the corpus callosum, and difficulties resulting from agenesis of the corpus callosum; (2) presents a medical and psychological evaluation of the subject (based on preschool through secondary level data); (3) describes the academic intervention in primary school; (4) discusses her educational experience in a rural Australian town; and (5) presents her current level of psychological, academic, and social performance as well as her current employment position since completing high school. The subject currently leads a relatively normal life for which, it is suggested, the highly supportive family and regular primary school program may have been primarily responsible. (23 references) (DB)

# Educational Implications for Agenesis of the Corpus Callosum

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International Council for Exceptional Children
Annual Conference
Baltimore, Maryland
April 17, 1992

In this presentation, a case study of a 20 year old young adult, born with agenesis of the corpus callosum will be discussed. I first met her when the regional guidance counselor approached the Schonell Educational Research Center of the University of Queensland, Australia, to see if anyone at the Sir Fred and Eleanor Schonell Educational Research Center could provide her any support. At the time of the initial contact, she was seven years old, repeating first grade, and not meeting a great deal of academic success. She was attending a two-teacher school which did not have access to any special education support on any regular basis. She could transfer to a special school 20 miles away, but her parents decided against this. If at all possible, they wanted to have the subject attend the neighborhood school, where her sister was also in attendance and to avoid the commute that attending a school 20 miles away would entail. I was able to work as an itinerant teacher and worked with this youngster for the first semester of that school year (1979) and completed follow-up testing at the end of the school year. I also conducted additional assessment and intervention during 1980. I obtained additional data 3 years later (1983), and I assessed her again in 1988 and have maintained a sporatic correspondence with her since then.

This talk contains five objectives. They are:

1. to identify the types of collosal lesions, describe the results of sectioning of the corpus callosum, and to address difficultieswhich are a result of agenesis of the corpus callosum;
2. to present a medical and psychological evaluation of the subject (based on preschool through secondary data);
3. to describe the academic intervention in primary school;
4. to discuss her educational experience in a rural Australian town; and
5. to present her current level of psychological, academic, and social performance as well as her current employment position, since she completed high school in December, 1990.

One's brain is a double organ, consisting of right and left hemispheres united by a network of 200 million nerve fibers called the corpus callosum. The corpus callosum might not be intact for several reasons. A collosal lesion might result from

1. infarction (circulation blocked by dead tissue), (might result in left side apraxia [loss or impairment of ability to execute movements without muscular paralysis] or motor aphasia [the loss or impairment of the power to use words as symbols of ideas that results from a brain lesion]);

2. a tumor arising on this site, resulting in aphasia, apathy, intellect, and motor impariments;

3. Marchiafava-Bignami's disease in which demylineation of the central nervous system occurs (myelin is the protective sheath). This is associated with alcoholism, lower intellect, severe memory loss, seizures, aphasia...;

4. sectioning of the corpus callosum, a practice for treating intractable epilepsy (not easily relieved, cured, not responsive, as to a medicine); and

5. by failure to develop, described as agenesis (Elliott, 1969).

Note: the first three causes also result in damage to neightboring areas and, therefore, the effects or "damage" depend on amount of damage to neighboring areas.

The functions of the corpus callosum are unclear, however, some effects of callosal lesions are known. Some known effects resulting from sectioning are: When an object is placed in each hand (beyond the visual field), the sectioned subject frequently denies the presence of left hand stimulus while describing the object held in the right hand. The callosal sectioned individual might also be unable to transfer skills learned in one hand to the opposite hand, resulting in each side having to be taught how to do the same task separately (e.g., learning a "route" in a tactile maze) (Ettlinger, Blakemore, Milner, & Wilson, 1977; Sperry, 1971).

A second example of this inability to transfer laterally occurs when the individual with a sectioned corpus callosum perceives two visual images presented simultaneously to each visual half-field for less than 0.01 second. When the subject is to retrieve a matching object by touch with her left hand, the individual selects only the object shown on the right hemisphere (perceived through the left eye). If she is asked what she has chosen, before looking at the object she has retrieved and is holding, she responds with the name of the object seen by the left hemisphere (as seen through her right eye). Visual deficits of this nature cause few difficulties in daily activities because ordinary eye movements (scanning) brings pictures of the left visual hemisphere into the right visual half-field (Chiarello,

1980; Sperry, 1971).

There are other examples of denials and differences between the right and left hemisphere occurring following sectioning of the corpus callosum. The degree of loss of lateral transfer varies, which might be due to further commissural damage occurring during the sectioning to some patients.

## Agenesis of the Corpus Callosum

Incidence estimates of callosal agenesis vary from 0.3% to 0.7% (Drukemiller, 1953 and Grogno, 1968, respectively, cited in Dimond, 1972). However, when examining the population defined as mentally retarded, the incidence is estimated to be two percent. The corpus callosum begins to develop in the 10th week of fetal life and is usually complete by the 20th week (Chiarello, 1980; Rakic & Yakovlev, 1968, cited in Lewis, Reveley, David, & Ron, 1988). Partial or total agenesis of this structure is generally associated with one or more additional congenital deficits of the brain and usually results in mental deficiency, seizures, and motor disturbances (Lewis et al.). Lewis et al. continued, stating that, "The most common single characteristic of acallosal individuals is severe mental retardation." However, it is unclear if the retardation results from the callosal absence, but rather, is a concomitant pathology since some acallosal subjects exhibit average and above average levels of intelligence (Chiarello; Dennis, 1981; Jeeves & Temple, 1987; Solursh, Marguiles, Ashen, & Stasiak, 1965). Motor symptoms vary in type and severity, ranging from slight awkwardness to severe problems of athetosis (continual slow movements, especially of extremeties) (Dimond, 1972; Elliott, 1969). Deficient motor coordination is reported by several investigators in acallosal individuals (Bruyer, Dupuis, Ophoven, Rectem, & Reynaert, 1985; Lewis et al., 1988).

There is general agreement of impairments of behavior which result from surgical sectioning of the corpus callosum. There is conflicting evidence, however, concerning the presence of similar impairments where there is callosal agenesis (Ettlinger, et al., 1972). Impairments commonly suspected of acallosal individuals include: limited interhemispheric transfer of knowledge, bi-manual coordination tasks deficits, impaired cross-lateralization of touch, and interocular transfer of movement deficits.

Some investigations report dramatic deficiences in the transfer of some information from one side to the other (Meerwaldt, 1983; Reynolds & Jeeves, 1977). Sauerwein, Lassonde, Cardu, and Geoffroy (1981) and Sauerwein and Lassonde (1983) reported transfer to occur, but it required more time than the control subjects required. With regard to bimanual motor activity, Jeeves, Silver, and Jacobson (1980) suggested that "for fast coordinated, highly skilled bimanual performance, an intact functioning corpus callosum is necessary" (p. 849). There is evidence that when congenital absence of the corpus callosum

occurs, the brain develops some other pathway(s) to transfer interhemispheric knowedge.

Language deficits in acallosal individuals are also reported; however the nature of the deficiency varies, from specific difficulties to overall delayed language. Temple, Jeeves, and Vilarroya (1989) reported rhyming deficits, as did Jeeves and Temple (1987) for one subject. Dennis (1976) and Sanders (1989) reported difficulty with syntactic comprehension. In a second subject studied by Jeeves and Temple, they reported widespread language deficits.

Studies of acallosal agenesis use very small samples; at times only one subject is under examination. Some studies include partial and complete collosal lesions. Related cerebral damage is not always known, so the behaviors exhibited might be due to accompanying brain injury rather than to the callosal damage itself. A callosal lesion definitely suggests behavior impairments; however, precise description of both the general and the more sublte symptoms awaits further investigation. Reynolds and Jeeves (1977) summarized their conclusion similarly, The behavioral variation in acallosals may be idiosyncratic within rather broad limits" (p. 271).

Personal History

The subject, born in 1972, is the second of dyzygotic twin girls (so a natural control was available) and has two older siblings. At the age of two months, an air study diagnosed the agenesis of the corpus callosum and the possibility of communicating hydrocephalus was suggested. A medical examination at 30 months indicated that her head size was within normal limits. Development of the subject was slower than that of her twin sister (whose development was within normal ranges), but of a normal developmental pattern. She had slender built when I first met her and was of normal height; she was still slender when I last saw her,at age 16, and nearly as tall as I. Her forehead protrudes slightly; however she covers the protrusion with her bangs.

Educational Background

The subject attended a rural, two teacher school (grades 1 - 7, with 1 - 4 being in the lower school and grades 5 - 7 in the upper school; there were 18 students in the lower school), about 20 miles from a medium sized city and 50 miles from Brisbane, the state capital of Queensland. There was no regular itinerant or other special education service available at the school. The parents were given the option of having their daughter attend a segregated school for children who were (mildly)mentally handicapped in a medium sized city about 20 mile away. They preferred not to require her to make that commute and enroll her in the special school, but to send her to her home (neighborhood) school; effectively denying any right to special education services on a regular basis.

During my first meeting with the subject, I observed her in both large and small group work, and met with her individually. When involved in the large group "morning talk" session, she responded in short phrases and only when directly asked a question. She was attentive. The subject took a much more participatory and active role in the small group work. During the initial individual session, she was cooperative, but continued to answer only questions asked to her directly. She spoke in concise responses, speaking quietly, but audibly. The subject had several enunciation difficulties ('b' for 'v' and 'sr' for 'thr'). She maintained little eye contact when talking. She recognized her printed name, identified no letter names or sounds, and her handwriting, which was low and laborious, bore little semblence to the model (of letters) she was asked to copy. Her tracing was quite accurate.

Observing the subject in both classroom and outdoor activities showed her to be adept at running and climbing. Balancing on one foot and maintaining a "frozen" position for several seconds was difficult for her. She preferred using her left hand, but could complete nearly any activity with her right hand about as well. She was unable to manipulate paper and scissors simultaneously.

Assessment

The following assessment results were available. On the McCarthy Scales of Children's Abilities, when 4 years 4 months old are: General Cognitive Index--73 (mean = 100, standard deviation = 16), Verbal--34, Perceptual-Performance--40, Quantitative--32, Motor--45, Memeory--39 (means for these latter 5 scales = 50, standard deviation = 10). Her twin sister scored within the average range of all six scales (Field, 1976). Conclusions drawn by Field were:

> Two behaviours elicited by the subject were an inability to describe verbally an object in her non-dominant hand (other than the ball) and her ability to manipulate pegs into place using her right (non-dominant) hand without vision, although she did not exhibit this behaviour with vision).

The subject's results on the Weschler's Pre-School and Primary Scale of Intelligence when she was six years, three months old placed her with an IQ in the mildly intellectually handicapped range, with similar results to the scores earned on the McCarthy Scales of Children's Ability. On the Illinois Test of Psycholinguistic Abilities (ITPA), at seven years, one month, the subject's mean was four years, nine months. On the Boehm Test of Basic Concepts, Form A, she identified 22 of the 50 concepts correctly. Results from Concepts about Print Test entitled 'Sand', administered at seven years were:

> She was able to identify the front of the book, where to begin reading (including print presented on a left page and on a right page, seen together), in what order to read across the

page and down the page. She was unable to locate the first and last part of the story as well as being unable to identify the bottom of a picture. Word and letter reversals went unnoticed by the subject. She identified no words, no punctuation marks, and no lower or upper case letters.

It was noted that her twin sister would speak "for" the subject, both at home and at school.

Field (1976) noted that the subject was unable to describe verbally an object placed in her non-dominant hand (other than the ball) without using vision. The subject repeated a similar task throughout the intervention. The results of these activities are presented in Table One.

Two and a half years earlier, the ball was the only object the subject was able to identify, when placed in her right hand and without using her vision. During the intervention, she identified 80% of the objects correctly. This suggests that development has taken place enabling her to transfer from one cerebral hemisphere to the other, between the ages of 4 1/2 and 7. The subject's inability to identify properly the knife supports the comments by Dennis (1976) suggesting that the corpus callosum needs to be present during fetal development to acquire finely differential sensation within each hand (see Table One).

The Weekly Program

The intervention occurred on a weekly basis, for 90 minutes per week and in her classroom. It began approximately one month into the school year. The school year was divided into three terms, approximately 14 weeks each. The intervention continued through the first term and continued about halfway into the second term. On the basis of the assessment results and the initial meeting with the subject, the classroom teacher and I decided to concentrate on language development, concept development, reading, and handwriting. Regular (approximately every other week) meetings with the subject's mother occurred at school throughout the intervention.

During the intervention, the teacher and I expected the subject to begin to rely on her oral language. She initially spoke in two to three word phrases. By the beginning of the middle third of the school year, she was initiating conversation, maintaining eye contact when speaking, and expressing herself in simple but complete sentences. Her mother was given suggestions on ways to encourage her daughter to express herself orally.

The subject's motivation to read was extremely high. Her desire to have her own 'real' book prompted introducing her to a sight vocabulary from the Endeavor reading series. Although repetition was required initially to acquire a new sight vocabulary word, she was able to retain this knowledge. Family members were encouraged

to read to her as well as encouraging her to read to them. The subject did very poorly on rhyming and phonics activities. She saw reading to be the recognition of an entire word and encountered difficulties breaking down a word into individual letters. The initial concepts not recognized on the "Boehm Test of Basic Concepts" were the basis for the concepts worked on with the subject. After manipulating objects to teach a concept, the concept was depicted on paper. This proved difficult for the subject.

The subject could trace letters accurately, however, she found it difficult to copy the same letters. The further away from the jmodel, the less accurate the spatial relationship between the letters (e.g., the two "G's" and the "e" in the name 'Digger' were raised. She also confused similarly formed upper and lower case letters (e.g., 'K' and 'k', 'P' and 'p'). Other visual perception difficulties arose when the subject put together picture puzzles. She was unable to visualize the line from one piece continuing into the adjacent piece and thus complete the puzzle.

Close liaison with the subject's teacher resulted in complimentary programs for the subject. The subject received additional support as necessary with her class work from the teacher. At the beginning of the second school term (the middle third of the school year), the subject was keeping up with the grade one group in concept development, number work, and handwriting. After the intervention concluded, the subject continued to read at her own pace. Ongoing monitoring by me was provided periodically. The subject's long-term memory was a strong asset to her. Although she was frequently unable to retell an event with as great detail, once she has overlearned a concept or to read a specific word, her retention was good.

The bi-weekly meetings with the subject's mother enabled questioning on the part of the teacher and me. I was able to make suggestions to her mother on ways to enhance oral language, reading, and concept development at home. The subject's mother was able to provide background and related information, as well as discuss her daughter's progress.

The subject liked to be correct. She frequently asked questions, even when she could provide the correct response. She sought encouragement while she worked. When unsure of a response, she tried to get the answer from the person instructing her. She waited to reply until someone else would give her a hint by mouthing the word. She sought frequent reinforcement, although this varied and ther were days when she sought little reinforcement and on other days, would seem to need reinforcement after individual responses.

## Summary of the Intervention

The subject was able to benefit from classroom learning. The

small class size enabled the teacher to supervise her closely. The intensive work carried out individually with the subject appeared to be sufficient for her to continue learning effectively within the group environment. Reading proceeded at an individual basis through grade seven, so she continued on her increasing her sight vocabulary. Her heightened motivation to read continued throughout her public school career. Although she exhibited an intellectual handicap and motor disturbances as generally manifest by acallosal individuals, capitalizing on her instrinsic motivation provided maximum use of the abilities she possessed. Her handwriting was similar to her classmates through lower elementary school, but did not "mature" as she entered upper grades. The lower school teacher continued to be aware of her weaknesses spatial perception and continued to provide the necessary support to minimize and to overcome difficulties presented by this weakness. She continued to progress through the lower school with children in the earlier grades.

Follow-Up: 1980 (C.A. = 7 yr. 11 mo. to 8 yr. 2 mo.)

The following year (1980), when the subject was in second grade, intervention continued at the request of the classroom teacher and the regional guidance counselor with 8 sessions, that took place on an every other week basis between February and early June. Instruction continued in the areas studied in the first year of intervention: language development, concept development, reading, and handwriting. The subject was also administered several assessments during this time. Her test results on the Weschler Intelligence Scale for Children, Revised were a full scale IQ of 69, a verbal IQ of 73 and a performance IQ of 69. Her scaled scores were between 3 and 7, with an '8' in object assembly (see Table Two). On the KeyMath Diagnostic Arithmetic Test, she scored at a grade level of 1.5; it was the beginning of second grade for her (although she repeated grade one, so it was her third year of school). On the ITPA, her psycholinguistic ability (PLA) was 5 years, 10 months (C.A. = 7 yr., 11 mo.), with fairly consistent performance across the individual subtests (see Table Three). This test was administered nine months earlier and the subject scored a PLA of 4 years, nine months, suggesting 13 months growth in this area. When administered the Lincoln-Oseretsky Motor Development Scale, she scored at the 19th percentile for all students; 20th percentile for girls, based on age norms. On the Harris Test of Lateral Dominance, she consistently used her left side on hand, eye, and foot activities. When asked to follow instructions, to point our or to use her left and right side (hand, eye, and ear) the subject demonstrated some inconsistencies with her eyes open and showed no successes when her eyes were closed (see Table Four).

Follow-Up: 1983 (C.A. = 10 yr. 11 mo.)

The subject was reassessed at the beginning of fifth grade. An assessment of her reading, based on the Neale Analysis of Reading Ability Test, indicated her reading accuracy age to be 8 years, 1 month and her comprehension to be 6 years, 3 months. On the Milton Word Recognition Test (normed on Queensland students), she placed at the mid-year second grade. She relied heavily on her visual skills to read; her phonetic and auditory skills were very poorly formed. In mathematics, she was unable to complete any multiplication and division problems, did not know even and odd numbers and place value was not well developed (based on the P.E.O.M.A. Year 3 Maths Profile). She worked well one on one, but did not follow directions well if left to do independently. Her hand writing (left handed) was quite neat, in spite of her pencil grip being awkward. She tried extremely hard during the testing situation. The report indicated that she was mixing well socially, was happy, and not a behavior problem. The 2-teacher school continued to give her a non-grade, individualized program. It was recommended that she continue in the same school until the end of seventh grade (the normal point of departure) and then attend the special school in the city 20 miles away.

Follow-Up: 1988 (C.A. = 16 yr. 4 mo.)

The subject was last assessed, both formally and informally, in July, 1988. At the time, she was in her second to last year in high school. A segregrated special school for high school students identified as mentally handicapped opened when she was about to enter high school (eighth grade), adjacent to what would have been the high school she would have attended if she needed no special education placement. Thus, the need to commute 20 miles for a special school was avoided. I met with her on two occasions at her high school and once informally, with her parents, her twin sister, and her former elementary school teacher, for dinner.

Her high school experiences, in a class for students identified as mildly intellectually handicapped, were generally positive and happy ones. She was a leader in her class of 12 adolescents. She was outgoing, tutored some of the other students, and had numerous friends. As indicated earlier, she is tall, slender, and had no physical deformities. She looked like a 'normal' adolescent, who was interested in clothing, following local sports, and wanted a job so she could earn some money.

Academically, she was performing on fourth through sixth grade level. Word recognition skills and basic math facts were at the higher level; comprehension and problem solving were lower. Her written expression was also at an upper elementary level. She continued to print, but did so reasonably efficiently. When administered tactile-only identification tasks, she was easily able to identify correctly every object placed in either hand (and out of sight). A copy of a letter she wrote recently (mailed March 25, 1991), shows the quality of her handwriting.

Several school experiences were work-related. One jobs she held, during her junior year in high school was that of a day care worker, which she quite enjoyed, and said she would like to do after finishing high school. Her second position was that of running a cash register at a local store. While, according to her teacher, she did fine at the job, although she was not as fast at running the cash register as others might be. The subject said she did not like the second position as much as the first job experience.

When I met her socially with her parents and sister, she was relaxed. She joined in the conversation when addressed and when the topic was something about which she was quite familiar. When a topic was discussed on which she had little knowledge, she was quite reticent to speak up. She had a number of responsibilties at her home, which is on a farm. Her parents were concerned about her future, and her mother indicated that if her daughter were to get married and have a family, they would continue to be supportive. Her mother indicated she did not anticipate this occurring soon, since the subject is still emotionally immature and expressed no interest in dating. He mother stated that she hoped this daughter would have a home of her own some day.

## Implications of Rural Education for the Subject

This brings me to my final objective of this presentation. This young woman attended schools about 50 miles from a major city (population over 1,000,000) and about 20 miles from a smaller city (population about 75,000). She received an individualized educational program during her elementary grades (grades 1 - 7), which was augmented with intensive remedial classes for half of one year and for a portion of a second year. Infrequent consultation with her classroom teacher from me occurred during those two years. Since then, the school strove to meet her needs, with occasional support from regional guidance personnel, but not with any additional resource/remedial teacher. By the time she was to enter high school, her home high school opened a special education class for students identified as mentally handicapped. At this school, her educational program was similar to that of her classmates. Her parents were extremely supportive, giving her a number of responsiblities at home on their farm. The amount of responsibilities increased as she got older.

Had the subject lived in a larger area (as opposed to the nearest school being a 2-teacher school for grades one through seven), and special education services were available, she would have attended a segregated special school. In fact, the regional eueuance personnel suggested that the subject attend the special school and be transported daily. The subject's parents refused this option. The extremely highly supportive family and school allowed this student to progress well. While it is not known how well the subject would have progressed had she attended "only" special schools, it is my opinion that the individualized program

implemented at her rural school provided her optimal learning experiences and opportunities. The subject did, in fact, benefit from an individualized educational program. It was never formalized, but it was effective, which is supported with the periodic evaluations by the regional guidance personnel.

The subject is now a young lady who wants a joh, who has friends ,who has responsiblities at home, and enjoys her family. Her public schooling is behind her and was, by and large, overwhelmingly positive for her. The deficits commonly associated with agenesis of the corpus callosum are mental retardation, motor involvement, seizure activity, and lateral transfer difficulties. She consistently scores in the upper range of mild mental retardation, with her academic performance, social, and language skills reflecting this. She demonstrated slight motor disabilities when in elementary school; these are now minimal, although she performs many actions more slowly than her age would indicate, but parallel to what one could expect of an individual with her IQ. She has no history of seizure activity. An increasing number of studies of acallosal individuals suggests that difficulties manifested when these persons are preschoolers and are presumed due to the agenesis of the corpus callosum are compensated for as other alternate pathways develop, thus involving minimal deficits caused by the agenesis. This subject seems to be similar to the other acallosal individuals described in the literature.

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Table One

Identifying Objects by Tactile Stimulation

C.A. = 7 yr. 1 mo.

| | |
|---|---|
| First Trial | |
| Tactile stimulation only | The subject correctly identified: |
| Left Hand | ball, spoon, ring, button, and knife |
| Right Hand | cup, chair, car, bell<br>said 'square' for block<br>said 'stick' for knife |
| Second Trial | |
| Left Hand | ball, doll, key, paper |
| Right Hand | pencil, button, spoon;<br>said 'stick' for 'knife' |

Table Two

Weschler Intelligence Scale for Children - Revised

C.A. = 7 yr. 11 mo.

| Verbal Tests | Scaled Scores |
|---|---|
| Information | 3 |
| Similarities | 7 |
| Arithmetic | 6 |
| Vocabulary | 6 |
| Comprehension | 6 |
| Digit Span | 7 |
| **Performance Tests** | |
| Picture Completion | 7 |
| Picture Arrangement | 3 |
| Block Design | 4 |
| Object Assembly | 8 |
| Coding | 4 |
| Mazes | 4 |
| | **Intelligence Scale** |
| Verbal Score | 73 |
| Performance Score | 69 |
| Full Scale Score | 69 |

Table Three

Illinois Test of Psycholinguistic Abilities

C.A. = 7 yr. 11 mo.

| Subtest | Age Score |
|---|---|
| **Representational Level** | |
| Auditory Reception | 5 yr. 6 mo. |
| Visual Reception | 6 yr. 2 mo. |
| Auditory Association | 6 yr. 0 mo. |
| Visual Association | 4 yr. 10 mo. |
| Verbal Expression | 5 yr. 2 mo. |
| Manual Expression | 5 yr. 3 mo. |
| **Automatic Level** | |
| Grammatic Closure | 5 yr. 6 mo. |
| Visual Closure | 5 yr. 8 mo. |
| Auditory Memory | 7 yr. 7 mo. |
| Visual Memory | 7 yr. 3 mo. |
| Auditory Closure | 4 yr. 4 mo. |
| Sound Blending | 7 yr. 4 mo. |
| Composite PLA | 5 yr. 10 mo. |

NOTE: Previously administered at
C.A. 7 yr. 1 mo.; PLA was 4 yr. 9 mo.
PLA was 4-9

Table Four

Following Directions

C.A. = 7 yr. 11 mo.

Eyes open

| Show me your: | Correct | Incorrect |
|---|---|---|
| 1. left hand | X | |
| 2. right eye | X | |
| 3. right hand | | X |
| 4. left ear | X | |
| **Touch your ____ ____ with your ____ ____** | | |
| 5. left ear, left hand | X | |
| 6. right eye, left hand | | reversed |
| 7. right knee, right hand | | reversed |
| 8. left eye,left hand | X | |
| 9. right ear, left hand | | reversed |
| 10. left knee, right hand | | reversed |
| 11. right ear, right hand | | reversed |
| 12. left eye, right hand | | X |

Eyes closed

| Show me your: | |
|---|---|
| 13. right hand | X |
| 14. left leg | X |
| 15. right eye | X |