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An analysis of teaching mathematics and reading to learning disabled children's preferred perceptual modes

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AN ANALYSIS OF TEACHING MATHEMATICS AND READING
TO LEARNING DISABLED CHILDREN'S
PREFERRED PERCEPTUAL MODES

A MASTER'S PROJECT

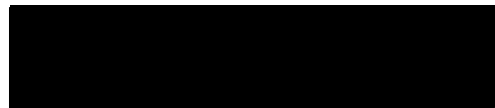
Submitted to the Department of Teacher Education
University of Dayton, in Partial Fulfillment
of the Requirements for the Degree
Master of Science in Education

by

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The School of Education
UNIVERSITY OF DAYTON
Dayton, Ohio
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Approved by:

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Advisor

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PART I

BACKGROUND

Educators have long been concerned with the best methods of teaching. We can no longer assume that all students will learn through whichever strategy the teacher prefers to use. All children do not learn the same way, so no single instructional approach provides optimal learning for all children. (Bloom, 1968; Cronbach, 1957; Glaser, 1967). The assumption is that individual children have unique learning characteristics or aptitudes; therefore, instructional programs should be prescribed according to these differences. (Foster, Reese, Schmidt, and Ohrtman, 1976).

Thus educators began exploring the field of individualized instruction. They soon recognized the benefits of individualizing instruction. One of the major premises underlying individualized instruction is that students are permitted to make decisions concerning (1) how much they believe they are able to achieve within a given time span, (2) the selection of materials through which they elect to learn, (3) where in the environment and with whom they choose to study, and (4) the conditions under which they will demonstrate mastery of their objectives. (Dunn, Price, Dunn, and Saunders, 1979).

Once students are cognizant of how they learn, they should be better able to make wise decisions concerning the instructional choices they are permitted. The kinds of decisions that a student makes concerning instructional choices should be related directly to his/her learning style - for different learning style characteristics appear to respond to different methods and resources. (Dunn, Dunn, and Price, 1977).

Information about a student's learning style may come from many sources: the student himself, his parents, his teachers, his peers, and learning style measures. (Hunt, 1979, p. 29).

Many educators feel that children would learn best if instruction were individualized according to learning styles,

but researchers offer many varying definitions of just what constitutes learning style.

Davis and Schwimmer (1981) divide learning style into two distinct categories: processing systems and input/output factors. Processing systems involve ways of organizing ideas. Input/output factors are ways in which content is best delivered to and expressed by the learner. In the field of education, the primary focus in learning style research appears to be on this input/output category.

Another definition is given by Fischer and Fischer (1979) who use "style" to refer to a pervasive quality in the behavior of an individual, a quality that persists though the content may change. The Fischers describe ten types of learners.

The first of these learners is the incremental learner. This learner proceeds in a step-by-step fashion, systematically adding bits and pieces together to gain larger understandings. This learner is a sharp contrast to the intuitive learner whose style does not follow traditional logic but leaps in various directions. The intuitive learner has sudden insights and derives meaningful and accurate generalizations from an unsystematic gathering of information and experience.

Some learners rely on their senses to gain knowledge. Fischer and Fischer (1979) describe two types of sensory learners. The sensory specialist relies on one sense for the meaningful formation of ideas. The sensory generalist uses all or many of the senses in gathering information and gaining insights.

The Fischers (1979) next look at the emotional aspect of the learner and describe the emotionally involved and the emotionally neutral learners. The emotionally involved learner functions best in a classroom in which the atmosphere carries a high emotional charge. The emotionally neutral learner functions best in a classroom where the emotional tone is low-keyed and relatively neutral.

Some students' learning is greatly affected by the class-

room structure. The Fischers (1979) describe the explicitly structured student who learns best when the teacher makes explicit a clear, unambiguous structure for learning. And in contrast they describe the open-ended structured learner who feels at home and learns best in a fairly open-ended learning environment.

Two other learners are described by the Fischers (1979). The damaged learner is physically normal yet damaged in self-concept, social competency, esthetic sensitivity, or intellect. The eclectic learner is one who can shift learning styles and function profitably.

Gregorc (1979) refers to learner's preferences for sequential or random learning in either an abstract or concrete form when discussing style. He states that learning style consists of distinctive, observable behaviors that provide clues to the functioning of people's minds and how they relate to the world. These "mind" qualities suggest that people learn in combinations of dualities: (a) concrete-sequential, (b) concrete-random, (c) abstract-sequential, and/or (d) abstract-random. Preferences for a particular set constitutes learning style.

Hunt (1979) feels that learning style describes students in terms of those educational conditions under which they are most likely to learn and essentially describes the amount of structure individuals require. "Learning style describes how a student learns, not what he has learned." (Hunt, 1979, p. 27). Learning styles are "accessibility characteristics" that provide keys to working more effectively with students. (Hunt, 1971). To say that a student differs in learning style means that certain educational approaches are more effective than others for him. (Hunt, 1979).

Dunn and Dunn (1975) define learning style as the manner in which at least eighteen different elements from four basic stimuli affect a person's ability to absorb and retain infor-

mation. These four basic stimuli are immediate environment, emotional make up, sociological reaction to people, and physical being.

Environmental elements include the influences of temperature, light and sound, and the need for either a formal or informal classroom design.

Emotional elements include the student's motivation, persistence, degree of responsibility when working independently, and the need for structure in the form of supervision and guidance or options.

Sociological elements include the child's ability and desire to work alone, with one or two peers, with adults, or in a small group or as part of a team.

Physical elements include the student's need for intake (food or drink), mobility preferences, time of day or night energy levels, and perceptual strengths.

Although researchers hold different opinions about what constitutes a child's learning style, they almost all agree that teaching to that child's style will improve his chances for success. A great deal of emphasis has been placed on this theory, especially in the area of special education.

Domino (1970) and Farr (1971) found that it is advantageous to teach and test students in their preferred perceptual modality. Although other research (Kampwirth and Bates, 1980) has not supported the practice of modality/instructional matching, the majority of special education teachers believe in and employ this model. They attribute this judgment, in large part, to their personal experience. (Arter and Jenkins, 1977).

According to Keefe (1979, p. 9), "a perceptual modality preference is a preferred reliance on one of the three sensory modes of understanding experience. The three modes are kinesthetic or psychomotor, visual or spatial, and auditory or verbal." Preference seems to change with age and evolve from

kinesthetic in childhood to visual and eventually auditory in later years, although there are exceptions to this. (Keefe, 1979). These shifts reflect the changing environment of children. Young children interact with peers and adults primarily by speaking and listening. When they enter school, however, the situation changes drastically. For much of their waking day, they are expected to use the visual modality (through reading) and the kinesthetic modality (through writing). Teachers suppress audition, sometimes, actively, in an effort to maintain an orderly classroom. Among adults and students in secondary school, audition becomes more important than kinesthesia. Individuals at these ages engage in fewer kinesthetic activities in school than elementary school children do, while oral/aural interaction increases somewhat. (Frostig and Horn, 1964).

Research has shown that approximately thirty percent of elementary school-age children have a visual modality strength, twenty-five percent have an auditory strength, and fifteen percent are kinesthetically oriented. The remaining thirty percent have mixed modality strength. (Barbe and Milone, 1980).

Dunn and Dunn (1978) claim that teachers usually teach by telling (auditory) and by assigning readings (visual) or by explaining and writing on a chalkboard (auditory and visual) and that teacher's tests are usually teacher dictated (auditory) or written or printed (visual). Therefore, many students who do not do well in school are tactual or kinesthetic learners who tend to acquire and retain information or skills when they are involved either with handling manipulative materials or by participating in concrete "real-life" activities. In terms of achievement, students with mixed modality strengths have a better chance of success than do those with a single modality strength because they can process information in whatever way it is presented. (Barbe and Milone, 1981).

Learning about learning styles will not alone solve the problems in education. But once educators begin to recognize

learning style as a way of organizing the world, it will become possible to provide appropriate settings for all students without disrupting the entire educational system. There is much good to be found in a traditional setting - for some learners; alternatives are essential for others. Knowing who belongs where will give educators a better focus as they make placement and curriculum decisions. Assessing learning styles should not trap individuals in pigeonholes, but should provide avenues to facilitate learning and intellectual growth. Nor should learning styles be considered as limiting factors, but as elastic categories that allow for truly individual learning. (Davis and Schwimmer, 1981).

Each of the studies reviewed shows that many different things are involved when assessing a student's learning style. But they also point out the importance of treating each child as an individual when planning an educational program, to ensure the child's greatest success.

Problem Statement

The purpose of this study is to determine if learning disabled children's perceptions of how they learn is supported by results obtained from their exposure to different types of learning modes.

PART II

PROCEDURES

Subjects: A group of four third grade students, ranging in age from eight to ten years old, were used in this study. There were three boys and one girl. Although all the subjects were in the third grade their reading levels ranged from 2.2 (second grade, second month) to 3.1 (third grade, first month) and their mathematics levels ranged from 3.0 (third grade) to 3.8 (third grade, eighth month).

These students had been identified as learning disabled children due to a discrepancy of at least two years in their academic achievement and their intellectual ability. Testing for placement in the learning disability program was done by a school psychologist and included results from the following tests: Devereux Elementary School Behavior Rating Scale, Wechsler Intelligence Scale, Illinois Test of Psycholinguistic Abilities, Peabody Picture Vocabulary Test, Peabody Individual Achievement Test, and the Gender Gestalt Test of Visual Motor Development.

The students had been in the learning disability program anywhere from one to three years. They are mainstreamed into the regular classroom for all special classes (art, music, and physical education). The learning disability teacher was responsible for mathematics and reading. A Houghton Mifflin reading program which stresses phonics, basically an auditory approach, had been used most with the children. For mathematics, a D.C. Heath program had been used which utilizes a visual approach.

Setting: The school which the subjects attended is a small elementary school (approximately five hundred students) in a rural setting.

The lessons were conducted in the learning disabilities classroom by the researcher, while the regular learning dis-

abilities teacher worked with the other learning disabilities students who were in the classroom. The lessons were taught to all subjects at the same time except when one student was absent. The student who had been absent was later taught the lessons and was tested individually. The Learning Style Questionnaire, used to determine a child's preferred perceptual modality, was also administered in the learning disabilities classroom. It was done individually, as it allows the students to read the questions themselves or have the questions read to them.

Instrumentation: The lessons taught for each subject and each perceptual mode were planned and taught by the researcher. Posttests for each lesson were researcher constructed. Portions of the Learning Style Questionnaire (Dunn and Dunn) were given by the researcher to determine the children's preferred perceptual modalities.

Definition of terms: Learning style - distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment.

Preferred perceptual mode - a preferred reliance on one of the three sensory modes (kinesthetic, visual, and auditory) through which information is processed.

Kinesthetic learner - one who tends to acquire and retain information and skills when they are involved either with handling manipulative materials or by participating in concrete "real-life" activities.

Visual learner - one who processes information most effectively by sight or by forming a mental picture.

Auditory learner - one who processes information most effectively through the sense of hearing.

Learning disability - a psychological or neurological impediment to spoken or written language or perceptual, cognitive, or motor behavior.

Design of the Study: The study was conducted over a period of three weeks. Week one included the lessons for the auditory, visual, and kinesthetic learner in reading. Week two included the mathematics lessons. The lessons were limited to ten or fifteen minutes each. Immediately following each lesson a written posttest was administered. Week three included the administration of portions of the Learning Style Questionnaire to determine the children's actual preferred perceptual modalities, as perceived by them.

Specific Methodology:

Day One: The auditory reading lesson on sequencing was taught. The objective was that the children would listen to a set of directions being read. Then they would be asked to read the same set of directions and put them in the proper sequence. The researcher first explained her purpose in being there. Then the importance of listening carefully to directions was discussed. The researcher then explained what was expected of the students and asked for any questions. A set of directions taken from Betty Crocker's Cookbook for Children for making baked potatoes was then given orally. The children were then given the following posttest: Number these sentences from 1 to 10, putting them in the correct order for making baked potatoes.

- _____ Bake potatoes about one hour.
- _____ Season with salt, pepper, and butter.
- _____ Prick the skins with a fork to let steam escape while baking.
- _____ Heat oven to 400 degrees.
- _____ Scrub the potato skins with a vegetable brush.
- _____ Serve at once.
- _____ Squeeze until the potato pops up through the gash.
- _____ Choose medium potatoes, one for each person.
- _____ Cut a criss-cross gash on potato tops.
- _____ Rub the skins with fat to keep them soft.

Day Two: The visual reading lesson was taught. The objective was that the children would read a set of illustrated directions. They would then be given those same directions written out of sequence and be asked to arrange them correctly. The researcher first recalled what had taken place during the auditory reading lesson. Then the researcher explained what was expected of the children on that day. The children were then given a worksheet containing illustrated directions for making Peanut Honey Snack 'n Smacks taken from Highlights Magazine for Children. After being given time to read and re-read the directions for making Peanut Honey Snack 'n Smacks, the directions were taken from the children and they were given this posttest: Number these sentences from 1 to 10, putting them in the correct order for making Peanut Honey Snack 'n Smacks.

- _____ Put 4 teaspoonfuls of powdered milk and 1 teaspoonful of honey in the cup.
- _____ Get the food you will need: peanut butter, honey, powdered milk, dry cereal.
- _____ Take small bits in your hand and roll into balls.
- _____ Wash hands.
- _____ Add 2 tablespoons of peanut butter to the cup and mix well with a mixing spoon.
- _____ Wash hands and equipment, clean up kitchen, and enjoy your snack.
- _____ Get the equipment you will need: 1 measuring tablespoon, 1 measuring teaspoon, cup for mixing, spoon for mixing, sheet of wax paper, rolling pin, saucer.
- _____ Roll the balls in crushed cereal and place on saucer.
- _____ Add a little more powdered milk if the mixture is too gooey to roll.
- _____ Place 2 tablespoonfuls of dry cereal on wax paper. Crush with a rolling pin. Set aside until you need it.

Day Three: The kinesthetic reading lesson was taught. The objective was that the children would read, step-by-step, and follow a set of directions. Then they would be given those same directions out of sequence and be asked to arrange them correctly. The researcher first recalled what had taken place during the auditory and visual reading lessons. The researcher then explained what would take place during this lesson. A list of directions for making Pudding in a Cloud was then put up on the board. A child was then called on to read the first direction. The students then followed that direction by gathering the food that would be needed. The rest of the directions were read and followed in the same manner. When the Pudding in a Cloud had been made the children were given this posttest: Number these sentences from 1 to 10, putting them in the correct order for making Pudding in a Cloud.

- _____ Add two packages of pudding mix.
- _____ Gather the utensils you'll need: dishes, mixing bowl, spoons, mixer, measuring cup.
- _____ Spoon pudding into dishes.
- _____ Measure 6 cups of milk and pour into bowl.
- _____ Let pudding set for five minutes.
- _____ Gather the food you'll need: milk, cool whip, pudding mix.
- _____ Using the back of a spoon, spread cool whip up the sides of the dish.
- _____ Beat with mixer on lowest speed for two minutes.
- _____ Spoon about 1/3 cup cool whip into each dish.
- _____ Serve at once.

Day Four: The auditory mathematics lesson was taught. The objective was that the children would listen to one way to make a monetary amount and then be able to write another way to show that same amount. First the researcher discussed with the students as many ways as the children could think of

to make five cents, ten cents, twenty-five cents, fifty cents, and one dollar. The researcher then gave these directions for the posttest: Listen carefully. I will tell you one way to make each amount. Then you will write a different way to make that amount. This is the posttest that was then given:

1. thirty-one cents (children were told three dimes, one penny)
2. fifty-seven cents (children were told one half dollar, one nickel, two pennies)
3. twenty-nine cents (children were told one quarter, four pennies)
4. sixty cents (children were told six dimes)
5. eighty-three cents (children were told three quarters, one nickel, three pennies)
6. twenty-four cents (children were told four nickels, four pennies)
7. one dollar (children were told two half dollars)
8. forty-three cents (children were told one quarter, three nickels, three pennies)
9. seventy-five cents (children were told one half dollar, one quarter)
10. sixty-eight cents (children were told six dimes, one nickel, three pennies)

Day Five: The visual mathematics lesson was taught. The objective was that the children would be shown a picture of one way to make a monetary amount and then be able to write another way to show that same amount. The children were first shown a worksheet containing many different ways to make fifty cents and were asked to study it carefully. The following posttest was then given: The picture will show you one way to write each monetary amount, you write another.

1. fifty-eight cents
2. sixty-three cents
3. twenty-one cents

4. eighty-five cents
5. thirty-nine cents
6. twenty cents
7. fourteen cents
8. forty-two cents
9. seventy cents
10. ninety-two cents

Each child's test showed a different way to make each amount. For example: fifty-eight cents was shown as two quarters, one nickel, three pennies; one half dollar, one nickel, three pennies; five dimes, one nickel, three pennies; and five nickels, three dimes, three pennies.

Day Six: The kinesthetic mathematics lesson was taught. The objective was that the children would be shown a monetary amount, using play money, and then be able to write another way to show the same amount. The researcher first reviewed the concept that monetary amounts can be made in many ways. Each child was then given the opportunity to count out at least three different monetary amounts using the play money. The children were then given the following posttest: Using the play money I will show you one way to make the amount. You write another way.

1. eighteen cents (children were shown three nickels, three pennies)
2. forty-five cents (children were shown one quarter, two dimes)
3. thirty-three cents (children were shown three dimes, three pennies)
4. ninety-two cents (children were shown three quarters, one dime, one nickel, two pennies)
5. ten cents (children were shown one dime)
6. seventy cents (children were shown one quarter, four dimes, one nickel)
7. sixty-eight cents (children were shown two quarters, one

dime, one nickel, three pennies)

8. thirty-seven cents (children were shown three dimes, seven pennies)
9. twenty-five cents (children were shown one quarter)
10. forty-nine cents (children were shown one quarter, two dimes, four pennies)

Day Seven: The children were asked to complete the following portion of Dunn and Dunn's Learning Style Questionnaire. Each child chose to read it and complete it without researcher assistance.

True answers for the following questions indicate an auditory perceptual preference: 1b, 1c, 1e, 1f, 1g, 2a, 2b, 2f, 2g, 2h, 2i, 3c, 3h, 3i, 3j, 3n. True answers for the following questions indicate a visual perceptual preference: 1a, 1d, 1e, 1f, 1h, 1j, 2c, 2e, 2h, 2j, 3a, 3b, 3f, 3k, 3s. True answers for the following questions indicate a kinesthetic/tactile perceptual preference: 1h, 1i, 2d, 2i, 2k, 3d, 3e, 3g, 3l, 3p, 3q, 3r, 3t, 3u.

Learning Style Questionnaire

A. Perceptual Preferences

1. If I have to learn something new, I like to learn about it by:
 - a. Reading a book.
 - b. Hearing a record.
 - c. Hearing a tape.
 - d. Seeing a filmstrip
 - e. Seeing and hearing a movie.
 - f. Looking at pictures and having someone explain them.
 - g. Hearing my teacher tell me.
 - h. Playing games.
 - i. Going someplace and seeing for myself.
 - j. Having someone show me.
2. The things I remember best are the things:
 - a. My teacher tells me.

- b. Someone other than my teacher tells me.
 - c. Someone shows me.
 - d. I learned about on trips.
 - e. I read.
 - f. I heard on records.
 - g. I heard on the radio.
 - h. I saw on television.
 - i. I wrote stories about.
 - j. I saw in a movie.
 - k. I tried or worked on.
 - l. My friends and I talked about.
3. I really like to:
- a. Read books, magazines, or newspapers.
 - b. See movies.
 - c. Listen to records.
 - d. Make tapes on a tape recorder.
 - e. Draw.
 - f. Look at pictures.
 - g. Play games.
 - h. Talk to people.
 - i. Listen to people talk.
 - j. Listen to the radio.
 - k. Watch television.
 - l. Go on trips.
 - m. Learn new things.
 - n. Study with friends.
 - o. Build things.
 - p. Do experiments.
 - q. Take pictures or movies.
 - r. Use typewriters, computers, calculators or other machines.
 - s. Go to the library.
 - t. Trace things in sand.
 - u. Mold things with my hands.

Assumptions and Limitations: 1. It was assumed that each child would have a preferred modality and would not be of mixed modality strength.

2. This study was limited to only four students.

3. Constructing lessons which were strictly auditory, visual, or kinesthetic was very difficult.

4. Posttests were pencil-paper tests which may not be the best response mode for a learning disabled child.

PART III RESULTS

The results of the posttests and Learning Style Questionnaire are presented in the following chart.

FOUR STUDENTS AND THEIR PERCEIVED MODE OF LEARNING ALONG WITH THEIR VISUAL, AUDITORY, AND KINESTHETIC POSTTEST SCORES IN READING AND MATHEMATICS

Student	Reading			Mathematics			LSQ
	V	A	K	V	A	K	Perceptual Mode
A	60%	100%	60%	90%	90%	90%	Visual
B	50%	20%	30%	90%	100%	90%	Kinesthetic
C	60%	30%	40%	100%	100%	100%	Visual/Kin.
D	20%	30%	0%	70%	100%	100%	Auditory/Visual

Scores are shown for each student in this study for posttests in reading and mathematics as well as the child's perceived preferred perceptual modality as assessed by the child's responses to questions on the Learning Style Questionnaire.

Three lessons in both reading and mathematics were taught. One was geared to the visual learner, one to the auditory learner, and one to the kinesthetic learner. Posttests were given after each lesson had been taught. Tests were designed which consisted of ten questions and the top score was one hundred per cent. The percentages on the chart show the percentage of questions answered correctly in each of the areas: visual (V), auditory (A), and kinesthetic (K) for the reading lessons and the mathematics lessons. For example, student A scored 60% (in other words, 6 out of 10 answers were correct) in the visual reading lesson.

The LSQ (Learning Style Questionnaire) score shows the perceptual modality preference of each child. This score was obtained by tallying the number of true responses given by

the children which fell into each area (visual, auditory, and kinesthetic) as determined by the consistency key provided by Dunn and Dunn. Students A and B showed a definite preference for only one modality whereas students C and D showed an equal preference for the two modalities shown.

Many researchers (Dunn and Dunn, 1975; Price, 1979; Farr, 1971; Domino, 1970; et al.) claim that a child will do better academically if he is taught the material using his preferred perceptual modality. Results in this study do not necessarily support this theory. Student A views himself as a visual learner, according to his responses to questions on the Learning Style Questionnaire. Results of the posttests in mathematics would indicate his strengths in each perceptual mode to be equal, and he would be an auditory learner according to the test results in reading. His classroom teacher described him as an auditory learner although she claimed this was a mode which had been developed after his admittance to the learning disability program. Student B views himself as a kinesthetic learner which is not supported by posttest scores. These scores show this student to be a visual learner in the area of reading and an auditory learner in the area of mathematics. The classroom teacher views this student as a visual learner. Student C rated himself equally as a visual and kinesthetic learner. Test scores in mathematics support this. Reading scores place him as a visual learner first and secondly as a kinesthetic learner. The classroom teacher views this student as an auditory learner. Student D rated himself equally as an auditory and a visual learner. Mathematics posttest scores show a discrepancy in that the student scored equally well auditorily and kinesthetically. Reading scores tended to show a slight preference for the auditory mode. The classroom teacher views this students as a kinesthetic learner primarily although she claims he often falls back on the visual mode.

There are many possible reasons for the fact that the results of this study do not agree with researchers who claim

that a child will do better academically if he is taught the material using his preferred perceptual modality.

First of all the posttest for each lesson was written. This type of testing is basically visually and kinesthetically oriented. Therefore, an auditory learner would not do as well on pencil-and-paper tests as on an oral examination. Pencil-and-paper tests are often not the optimum response mode for the learning disabled (Barbe and Milone, 1981). They do not permit accurate assessment of known ability factors of many learning disabled students.

Another aspect of the posttest in reading that might contribute to the discrepancy in this study's results and the results of other studies is that perhaps there were too many details for the learning disabled child. Giving a learning disabled child a list of tasks to perform and asking him to remember each in order is a very difficult task. If the reading posttest had been divided into two sets of five directions instead of one set of ten directions, perhaps the results would have been more in line with those from other studies.

Another factor which very likely affected the results of this study is the fact that the children chose to read the Learning Style Questionnaire on their own. The format of the Learning Style Questionnaire is confusing, especially for children with a learning disability, who are below grade level in reading achievement. Perhaps choosing another measure for determining the children's perceptual modality, such as Kirk, McCarthy, and Kirk's Illinois Test of Psycholinguistic Abilities or the Swassing-Barbe Modality Index, would have made the results more consistent with other studies.

There is much debating about the validity of the Learning Style Questionnaire. Derevensky (1978) claims that the instruments and tests of modal preference are inadequate in determining modal strengths. Davidman (1981) claims that many of the Learning Style Questionnaire questions provide interesting information, but that this information should not be

taken as a clear and irrefutable indication of a child's pattern of learning. Dunn's test is based on self-perceptions; opinions provided by elementary school students, who have had limited exposure to different ways of learning and self-evaluation, should be considered speculative. (Davidman, 1981). This is especially true of learning disabled children who tend to change their opinions often. If the researcher were to go back now to the same students who were used in the study and administer the Learning Style Questionnaire, it is very likely that their answers to the questions would vary considerably from previous answers.

Another factor which may have influenced the results of this study was the assumption that each child would have one preferred perceptual mode. Thirty percent of all children have no specific modality strength. They are of mixed modality. For them, two or more sensory channels are equally efficient. (Barbe and Milone, 1980).

Although sex and handedness have little impacts on modality strengths, the influence of age is quite strong. Early elementary school children have more well-defined strengths. As they progress their modalities become mixed and interdependent. (Barbe and Milone, 1980). The children in this study were all third graders, which is the grade level at which Dunn and Dunn recommend beginning to use the Learning Style Questionnaire. But three out of four of the children in this study were older than the normal third grader. This is another variable which may have affected the results of this study in relation to other findings.

Teachers also have modality strengths which show in their classroom organization and the manner in which their instruction is carried out. (Barbe and Milone, 1980). The learning disability teacher of the children in this study views herself as visually oriented. This is also the preferred modality of the researcher. Barbe (1981) claims that there is a strong

interaction between student and teacher modality strengths and that certain combinations are associated with greater rates of achievement. Because the modality strengths of the learning disability teacher and the researcher were different from those of most of the students in this study, the results may have been adversely affected.

Barbe and Milone (1981) state "that while most adolescents and adults probably prefer to use their strongest modality, there is no guarantee this will be the case." This statement seems to be supported by this study. Simply knowing the child's preferred perceptual modality does not tell us whether teaching to his strength or deficit will benefit the child more. (Tarver, 1978).

Hunt (1979) explored the area of students having different learning styles in different subjects. He noted that the child's learning style was probably due to the structure of the subjects themselves, for example, mathematics is more structured than social sciences. According to Schmeck, as quoted in "Learning Style Researchers Define Differences Differently", the nature of the subject is very influential. Many individuals can change their strategies in response to the unique contextual demands of the instruction, the content, and the test. Reading and mathematics are both very structured subjects. But posttest results tended to show better scores for the whole group in the auditory mode for mathematics and in the visual mode for reading. In the elementary grades, reading is most often taught visually and mathematics is often taught more auditorily, which corresponds to the findings of this study.

It was interesting to note that posttest scores were much higher for mathematics than for reading. All students, according to achievement test results, were below grade level in reading, but close to or above grade level in mathematics, which might contribute to this. Another contributing factor could have been the subject matter of the lessons taught. Much

time is spent in the learning disabilities classroom teaching the children to function in every day life, therefore, much time would be used teaching the children about money and counting change. It is highly likely that not as much emphasis would be placed on the skill of sequencing. Sequencing is a very hard skill for not only learning disabled children, but for all children. Perhaps choosing a different reading skill would have produced higher posttest scores.

The results from this study seem to indicate that lessons for learning disabled children should not be limited to any one perceptual mode. In recent years, technology has made it possible for teachers to utilize multisensory media as well as individualize teaching techniques to more effectively provide rich learning experiences for school-aged children. Most youngsters function best when a combination of senses are involved in learning. Materials should be introduced through the strongest perceptual sense and reinforced through supplementary ones. If a child does not grasp a lesson when it is first presented, try another way, another modality. The secret is to teach to a child's sensory strength when he or she has become frustrated. A child with a learning disability should receive the benefits of every teaching tool we have, and the choice of these teaching tools should not be dictated by the results of only one modality test. (Petreshene, 1982).

PART IV
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Modality - it's the word of the 80's and an important turning point in the teaching practice. The importance of teaching to children's sensory strengths has been recognized by educators for some time but only now are we able to apply this technique to classroom practice. But should this practice be used to the exclusion of other techniques?

The intent of this project was to analyze and describe the effects of teaching mathematics and reading to learning disabled children's preferred perceptual modalities.

A descriptive approach to the problem was used with the basic research for this study accomplished through a search of the related literature in the field of learning styles. In addition, a series of lessons, which were geared to the three most common modalities (visual, auditory, and kinesthetic), were taught to a group of learning disabled children. Then the Learning Style Questionnaire was given to determine the preferred perceptual mode of the children in the study.

Posttests were given after each lesson in an effort to ascertain whether or not teaching to a child's preferred perceptual modality affects their achievement.

Student A scored highest auditorily in reading and equally well for each perceptual mode in mathematics. He viewed himself a visual learner on the Learning Style Questionnaire. Student B scored highest visually in reading and auditorily in mathematics. He viewed himself as a kinesthetic learner on the Learning Style Questionnaire. Student C scored highest visually in reading and equally well for each perceptual mode in mathematics. He viewed himself equally strong as a visual and kinesthetic learner on the Learning Style Questionnaire. Student D scored highest auditorily in reading and equally well auditorily and kinesthetically in mathematics. He viewed himself equally strong as an auditory

and visual learner on the Learning Style Questionnaire.

These results are in contrast with most studies which claim that students who are taught in their preferred perceptual modality will do better academically. Factors which may have influenced these findings include the use of a written posttest, the choice of the Learning Style Questionnaire to determine the children's preferred perceptual modalities, the assumption that the children would have only one preferred perceptual modality, the age of the subjects used, and the significance of the interaction between student and teacher modality strengths as espoused by Barbe (1981).

Finding out a child's modality preference and considering this preference in instructional planning, including selecting or developing media and materials and designing the physical plant may be helpful. But modality-based instruction is far from being a panacea. It is simply one effective approach for the frustrated learner; one more practical tool for diagnosing learning problems. It should not trap individuals in pigeonholes but should provide avenues to facilitate learning and intellectual growth.

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