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THE RELATIONSHIP BETWEEN INTELLIGENCE AND PERCEPTUAL MOTOR PERFORMANCE IN FOURTH GRADE STUDENTS

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THE RELATIONSHIP BETWEEN INTELLIGENCE AND PERCEPTUAL MOTOR PERFORMANCE IN FOURTH GRADE STUDENTS

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THE RELATIONSHIP BETWEEN INTELLIGENCE AND PERCEPTUAL MOTOR PERFORMANCE IN FOURTH GRADE STUDENTS

An Abstract of the Thesis by
Jaima Andrea Knox

The purpose of the present study was to determine the relationship between intelligence and perceptual motor performance in fourth grade students. An intact fourth grade class consisting of ten males and ten females was administered tests reflecting their intelligence and perceptual motor performance levels. Results of the study showed that there is a significant relationship ($P<.05$) between intelligence and perceptual motor performance in fourth grade students.

The study further showed that there was a significant relationship ($P<.05$) between intelligence and perceptual motor performance among fourth grade males. No significance, however, was found between intelligence and perceptual motor performance among fourth grade females.

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CHAPTER I

INTRODUCTION

One of the most significant problems facing educators today is how to respond to students' differences in achievement levels (Good & Brophy, 1973). The phenomenon of diverse achievement levels has been attributed to many factors: family and cultural background (Stedman, 1985); inadequate instruction (Hawley, Rosenholtz, Goodstein, & Hasselbring, 1984; Snow, 1986); poor learning environment (Flatley & Simms, 1986); student personality components (Cooper & Speece, 1988); learning disabilities (Foulks & Morrow, 1989); and intellectual ability (Travers, 1982). Along with the diversity in achievement levels comes diversity in ability levels. While the relationship between ability and achievement has been previously acknowledged by educators, an ongoing question has been whether ability causes achievement or achievement causes ability (Chalip & Stigler, 1986).

Many researchers have also struggled with this problem. In the last fifty years, there have been many attempts to relate developmental test scores, obtained during infancy, to standardized

intelligence tests, given later in adolescence and adulthood (McCall, 1972). One particular study showed children who were delayed in walking, talking or both have a significantly higher prevalence of low IQ's and reading difficulties (Silva, 1982). In support of this have been some studies showing a positive correlation between IQ and perceptual motor tasks (Rarick, 1971). Rarick took his study one step further to say that perceptual motor training would have a positive impact on the academic performance of children. Another study done with infants showed fast visual reaction times and high IQ scores to be positively correlated (Dougherty, 1993). A study by Jensen (1978) showed reaction time to be positively correlated with psychometric measurements of general mental ability. Smith (1987) noted the correlations between response time task measures and psycho-metric test scores of intelligence are so close that it seems very likely most reaction time measures are related to general intelligence. It is quite apparent that many studies have been done in this area but most are centered around reaction times and IQs.

Therefore, this study will serve as an attempt to investigate the correlation between intelligence and perceptual motor performance.

Statement of the Problem

The purpose of this study was to determine the relationship between intelligence and perceptual motor performance among male and female fourth grade students.

Null Hypotheses

1. There will be no significant relationship ($P<.05$) between intelligence and perceptual motor performance among male and female fourth grade students.

2. There will be no significant relationship ($P<.05$) between intelligence and perceptual motor performance among male fourth grade students.

3. There will be no significant relationship ($P<.05$) between intelligence and perceptual motor performance among female fourth grade students.

Research Hypotheses

1. There will be a significant relationship ($P<.05$) between intelligence and perceptual motor performance among male and female fourth grade students.

2. There will be a significant relationship (P<.05) between intelligence and perceptual motor performance among male fourth grade students.

3. There will be a significant relationship (P<.05) between intelligence and perceptual motor performance among female fourth grade students.

Significance of the Study

The challenge of any educational system is to provide for the development of a widely diverse group of individual students. Snow (1986) defined education as a developmental program in which the primary concern is human preparedness for the later states of life.

Recent attempts to increase achievement have focused on a "back to-basics" return to pre-1900 concepts of uniform curriculum, whole-group instruction, and lecture-recitation-seat work methods which disregard inherent individual differences among students and leaves the accepted measure of achievement test scores as priority (Stedman, 1985).

By determining if mental IQ does indeed positively correlate with ability in performance of perceptual-motor tasks, educators would be able to select certain children for specialized early educational

programs and experiences (McCall, 1972). The possibilities for improvement in our educational system would be greatly enhanced. The seven multiple intelligences identified by Gardner (1985): logical-mathematical; musical; linguistic; spatial; bodily-kinesthetic; intrapersonal; and interpersonal intelligence would possibly be more understandable and more easily teachable; therefore benefiting everyone involved.

Although some research has been done on the infant and early childhood years showing positive correlations between mental IQ and perceptual motor tasks, very little research has been done during the vital elementary years- the years that can "make or break" a child's self perception. One particular study done by McCall (1972) showed neither general intelligence nor much continuity from one age to another in the performance of so called mental tasks in the elementary years. This is why this study was important in showing whether or not there was indeed a significant relationship between intelligence and perceptual motor performance in fourth grade students.

Delimitations

1. The study did not attempt to improve intelligence or motor skills.
2. The sample was taken from Haderlein Elementary School in Girard, Kansas. The twenty subjects were male and female fourth graders.
3. The Culture Fair Intelligence Test was administered only one time to the subjects.
4. The subjects had three separate attempts at the grooved peg-board test.
5. The subjects had five, ten-second trials at the pursuit rotor.

Limitations

1. There was no way to control whether or not the subjects put forth their best effort in taking the Culture Fair Intelligence Test.
2. There was no way to control whether or not the subjects put forth their best effort in their grooved pegboard trials.
3. There was no way to control whether or not the subjects put forth their best effort in their pursuit rotor trials.

Assumptions

For this study the following assumptions were made:

1. All subjects would put forth their best effort in completing the Culture Fair Intelligence Test so valid scores for each subject will result.
2. Three trials at the grooved pegboard test were sufficient enough for one valid score for each subject to result.
3. Five, ten-second trials at the pursuit rotor test were sufficient enough for one valid score for each subject to result.
4. All of the subjects were properly placed in the fourth grade.

Definition of Terms

The following terms are clearly defined in the Second College Edition of The American Heritage Dictionary:

1. Adolescence- The period of physical and psychological development from the onset of maturity.
2. Adulthood- The stage of development in which one has fully matured.
3. Intelligence- The capacity to acquire and apply knowledge.

4. Intelligence Quotient- The ratio of tested mental age to chronological age, usually expressed as a quotient multiplied by 100.

5. Reaction Time- The time interval between the application of a stimulus and the detection of a response.

6. Standardized Intelligence Test- A test used to establish an intelligence level rating by measuring an individual's ability to form concepts solve problems, acquire information, reason, and perform other intellectual operations which meet set limits.

The following terms are clearly defined by Howard Gardner (1985) in his own book- Frames of Mind:

7. Linguistic Intelligence- Comprised of sensitivities to the meaning of words.

8. Musical Intelligence- Consists of sensitivities to pitch and rhythm.

9. Logical-Mathematical Intelligence- Involves the ability to explore patterns, categories, and relationships in a controlled, orderly way.

10. Spatial Intelligence- Consists of accurate visual perception.

11. Bodily-Kinesthetic Intelligence- Involves the ability to direct one's bodily motions and the capacity to manipulate objects skillfully.

12. Intrapersonal Intelligence- The capacity to detect and symbolize complex and highly differentiated sets of feelings.

13. Interpersonal Intelligence- The ability to notice and make distinctions among other individuals.

CHAPTER II

REVIEW OF THE LITERATURE

In a diverse group of individuals, it is inevitable that there will be a great deal of diversity in ability levels and intelligence levels. In some cases, however, ability and intelligence go hand-in-hand. The more intelligent the individual, the more ability the individual may have. Historically, intelligence has been considered to reflect the capacity to learn and therefore achieve (Campione & Brown, 1982). Efforts to measure the concept of "intelligence" and its relationship to achievement have been hampered by researchers' inability to develop and agree upon a central definition. Sahakian (1968) noted that Galton, one of the earliest explorers of individual differences, referred to intelligence as "natural ability". Jenkins & Patterson (1961) noted that Spearman defined intelligence as a factor common to all activities which may be said to be intelligent. Sartain (1967, p.338) noted that Alfred Binet defined intelligence as the "tendency to take and maintain a definite direction; the capacity to make adaptations for the purpose of attaining a desired end; and the power of autocriticism." Sartain (1967, p.344) noted that

Wechsler, the creator of the Wechsler Adult Intelligence Scale and the Wechsler Intelligence Scale for Children, described intelligence as "the aggregate of global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment." Since the earliest days of academic interest in intelligence, theorists have taken sides either viewing intelligence as a single, global entity or a compilation of several, separate factors. Thurstone (1938) believed that intelligence could not be viewed as unitary but as multiple factors--verbal, perceptual, number, speed, inductive reasoning, word fluency, deductive reasoning, rote memory, space, or visualization- which he considered to have equal weight. Linden (1968) noted that Thorndike also believed intelligence was best described as multifactored. He saw intelligence as resulting from a large number of interconnected intellectual abilities. Guilford, one of the most prominent multifactor theorists, proposed a three-dimensional "structure of intellect model" as a method of organizing intellectual factors (Sattler, 1982).

Gardner (1985) defined intelligence as being able to solve problems, or create products that are appreciated within different

cultures. His theory suggests the existence of seven, separate, autonomous intelligences which he considers to be present in each human being in varying degrees. Linguistic intelligence is comprised of sensitivities to the meaning of words, the order among words and the sounds, rhythms, and inflections of the words. Musical intelligence consists of sensitivities to pitch, rhythm, and timbre. Logical-mathematical intelligence involves the ability to explore patterns, categories, and relationships in a controlled and orderly way (Armstrong, 1987; Gardner, 1985). Spatial intelligence consists of accurate visual perception, the ability to make transformations upon one's perception and to recreate aspects of these perceptions once the visual stimuli have been removed. Bodily-kinesthetic intelligence involves the ability to direct one's bodily motions and the capacity to manipulate objects skillfully. Intrapersonal intelligence refers to the capacity to detect and symbolize complex and highly differentiated feelings and emotions. Interpersonal intelligence involves being able to recognize and make distinctions among individuals, their moods, temperaments, motivations, and intentions (Gardner, 1985).

Armstrong's (1987) contention is that current teaching methods addresses only two of Gardner's seven intelligences--linguistic and logical-mathematical. Armstrong states that our cultural and educational emphasis on linguistics and mathematical abilities has created a narrowness of school curriculum that teaches to only a portion of the population, leaving a large percentage of children struggling to learn and achieve with their non-dominant intelligences. Many of these children manage to maintain their grade levels through hard work and perseverance; other children, whose dominant intelligences are rarely addressed in the educational system, are left to fall behind.

Student achievement test scores have gained such significance that teacher job security, bonus pay, and promotions are often directly linked to these measures (Stedman, 1985). The logic behind this focus on tests is firmly based on the presumed validity of achievement tests to reflect actual student learning. Despite the fact that questions remain regarding these tests' reflection of actual learning, the emphasis on test scores continues and leads almost invariably to the counter- productive phenomenon of "teaching to the test." While studies of achievement scores indicate

a general increase in scores reflecting basic skills, scores on tests requiring inferential skills have declined or remained the same (Hawley, 1984). Some educators are concerned that testing emphasis increases school standardization and narrows schools' agenda to the extent of restricting student access to a variety of subjects and textbooks (Stedman, 1985). This narrowing effectively reduces the learning opportunities for students in whom linguistic and mathematical-logical abilities are not primary.

Individuals possessing higher levels of kinesthetic intelligence process knowledge through bodily sensations (Armstrong, 1987). Bodily-kinesthetic children are in general the ones who are highly successful on the playground and in physical education classes. They communicate effectively through gestures and other forms of body language and learn by moving or acting things out (Armstrong, 1987). These children, who naturally move and fidget in the classroom setting, are frequently referred for testing and are unfairly labeled hyperactive or learning disabled (Armstrong, 1987). In actuality, these children may be some of the more intelligent children in their classes whose level of intelligence is simply failing to be addressed by their teachers' teaching practices.

An important and widely accepted belief is that there is no one system or method of teaching that will result in achievement for all students, at all grade levels, under all circumstances (Hawley, 1984). However, with an understanding of a child's intelligence profile, the primary abilities can be used as a means of transmission for a variety of required subjects.

Although theorists throughout the history of formal education have suggested methods for addressing individual differences, the reality is that practices of teaching have remained basically fixed (Snow, 1986). Within narrow educational systems, students must adapt to the learning environment. While most are fairly successful within the traditional system, there are those who struggle to achieve.

Children high in bodily-kinesthetic ability learn best by moving and acting things out. Requiring students high in perceptual motor skills to sit for long periods of time subordinates their primary avenue of ability to areas of lesser skill. For children who are struggling in the classroom, it would seem prudent to discover where their strengths lie before labeling them hyperactive or learning disabled. Incorporating a perceptual motor ability test

which is free of linguistic and logical-mathematical biases could identify bodily-kinesthetic learners.

Thus, this study will serve as an attempt to show that the students scoring high on perceptual motor performance tests are the same children scoring high on intelligence tests; showing they are not "dumb" but actually rather intelligent. This finding will also show educators which students may need particular attention brought to their intellectual needs in order to be successful not only in recess and physical education but also in the classroom.

CHAPTER III

METHODOLOGY

The purpose of this study was to determine if there was a significant relationship between intelligence and perceptual motor performance among male and female fourth grade students.

Research Design

A descriptive design was used for this correlational study. A descriptive design means the methods used for analyzing the data are done for the purpose of description and classification rather than explanation. A correlational study means this study showed a correlation or relationship among the subjects and the tests given.

Subject Selection

The subjects for this study were twenty male and female fourth grade students currently attending Haderlein Elementary School in Girard, Kansas.

Instrumentation

The Culture Fair Intelligence Test was used as the intelligence measuring device of the subjects. This test is easy to administer and very effective in reaching an accurate measure of one's true level of intelligence. It is a "pencil and paper" test that is broken down into three scales, each designed for a different age group. The Culture Fair Intelligence Test is not influenced by cultural background or scholastic or verbal training. It is highly reliable (.76) and valid (.81) and is excellent for work with culturally and educationally deprived children and adults (Institute for Personality and Ability Testing, Inc. [IPAT], 1973). This is an important aspect of the test since the cooperating school district reports 22% of the total population falling beneath the poverty level and 40% of the district's students qualifying for free and reduced lunches.

The grooved pegboard is a simple device that measures perceptual motor performance. It consists of a surface with open slots and pegs that are to be manipulated into those slots. The subjects will be asked to quickly yet efficiently put one peg into every slot on the pegboard until each slot is filled.

The grooved pegboard is known to be a learning device, meaning the subject's scores should improve with each trial.

The pursuit rotor is another perceptual motor performance measuring device. It is a larger device consisting of a heavy, cube-shaped base and a light, manueverable wand. When turned on, a bright white light travels clock-wise on the top surface panel at a rate of twenty-five revolutions per minute. The subject is to trace the light with the wand for ten seconds. The score for each trial is determined by a chronometer which records the amount of time the end of the stylus was in contact with the revolving light during each ten second trial.

Procedures

Each subject was given both forms, A and B, of the Culture Fair Intelligence Test in one visit. The students took the test from their home room desks just as they would take any other test. This helped to alleviate any undue stress. Each subject had one attempt at the intelligence test.

The perceptual motor performance tests were given to each subject in the gymnasium during their regularly scheduled physical

education time. For the pegboard test, as soon as the tester said, "go", the subject began manuevering the pegs into the corresponding slots. The tester began timing the subject with a stop watch from the moment she said, "go", until the final peg is in place. This resulting number was the score for that trial. Each subject received three separate trials of which the best score was recorded. For the pursuit rotor test, the subject began tracing the white light with the wand when the tester said, "go", and stopped when the tester said, "stop". The resulting score was time on-target for the ten second trial. Each subject was given five, ten-second trials on the pursuit rotor. A final score on the pursuit rotor test was tabulated by taking the average of the five, ten-second trial scores. Thus, each subject had three, separate scores- one for the intelligence test, one for the pegboard test, and one for the pursuit rotor test.

Description of Data

The data collected was three scores per subject. One score resulted from the intelligence test and one score from each of the perceptual motor performance tests.

Data Analysis

The Pearson product-moment coefficient of correlation was used to analyze the data.

CHAPTER IV

ANALYSIS OF THE DATA

The purpose of the study was to determine the relationship between intelligence and perceptual motor performance in fourth grade students. The scores resulting from the administration of the Culture Fair Intelligence Test were used to determine the levels of intelligence in the students. Perceptual motor performance scores were obtained through measures on the pursuit rotor and grooved pegboard.

Subjects were students from an intact fourth grade class. Each of the three tests were administered to each student by one researcher.

The subjects were administered both forms, A and B, of the Culture Fair Intelligence Test. The totals of the two tests for each student were matched to a corresponding I.Q. score. The perceptual motor performance tests were also administered to each student. The best of the three trials for the grooved pegboard was chosen as the final score for each student. The average of the five, ten-second trials was the resulting score on the pursuit rotor test. The means

and standard deviations from the three tests are presented in Table I. Raw scores may be found in the Appendix A.

Data were analyzed with the Statview 512 program in the computer lab at Pittsburg State University. Pearson's r correlation coefficients were obtained and the results may be seen in Tables II-IV.

Table I

Means and Standard Deviations for the three tests: Intelligence, Pursuit Rotor, and Pegboard

Groups	Males		Females	
	Mean	S.D.	Mean	S.D.
Intelligence	113.2	20.4	120.2	5.7
*Pursuit Rotor	13.6	7.7	18.2	4.9
*Pegboard	74.6	28.9	56.1	3.7

* times measured in seconds

Table II

Correlation Coefficients for the Total Group

Tests	Pursuit Rotor	Pegboard	Intelligence
Pursuit Rotor		-.689*	.602*
Pegboard			-.733*
Intelligence			

*P<.05

Table III

Correlation Coefficients for the Males

Tests	Pursuit Rotor	Pegboard	Intelligence
Pursuit Rotor		-.776*	.719*
Pegboard			-.756*
Intelligence			

*P<.05

Table IV

Correlation Coefficients for the Females

Tests	Pursuit Rotor	Pegboard	Intelligence
Pursuit Rotor		.185	-.097
Pegboard			.098
Intelligence			

*P<.05

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

The purpose of the study was to determine the relationship between perceptual motor performance and intelligence in fourth grade males and females. A group of ten boys and ten girls in an intact fourth grade classroom was selected to be the subjects for the study. The Culture Fair Intelligence Test was used to measure intelligence in the students. Perceptual motor performance was measured through the use of the pursuit rotor and grooved pegboard tests. The intelligence test was administered to the entire group in two separate testing sessions. The perceptual motor performance tests were given to each student individually.

After all of the subjects were tested, data were analyzed with the Statview 512 program in the computer lab at Pittsburg State University. Pearson's r correlation coefficients showed that there were significant relationships ($P<.05$) among all three tests for the total group and for males. No significant correlations were found for females.

Conclusions

The following conclusions were reached based on the results of the study.

1. There was a significant relationship ($P<.05$) between intelligence and perceptual motor performance among male and female fourth grade students.
2. There was a significant relationship ($P<.05$) between intelligence and perceptual motor performance among male fourth grade students.
3. There was no significant relationship ($P<.05$) between intelligence and perceptual motor performance among female fourth grade students.

Discussion

The results of this study clearly indicate that there is a significant relationship between intelligence and perceptual motor performance among male and female fourth grade students. However, among females, there is no significant relationship. Logic behind significance for males and no significance for females is not definitely known. Since the sample size for each gender was equal, ten males and ten females, one must assume there is simply no

relationship between intelligence and perceptual motor performance for this particular group of females. No further conclusions could be drawn for the resulting data.

Recommendations

Based upon the results of this study, the following recommendations for further research were made:

1. The sample size be increased for each gender.
2. Different age groups of elementary students should be tested.
3. Analyze the same class using a different intelligence test.

relationship between intelligence and perceptual motor performance for this particular group of females. No further conclusions could be drawn for the resulting data.

Recommendations

Based upon the results of this study, the following recommendations for further research were made:

1. The sample size be increased for each gender.
2. Different age groups of elementary students should be tested.
3. Analyze the same class using a different intelligence test.

REFERENCES

Armstrong, T. (1987). In their own way. New York: J. Tarcher.

Campione, J.C., & Brown, A.L. (1982). Toward a theory of intelligence: Contributions from research with retarded children. In R.J. Sternberg and D.K. Detterman's How and how much can intelligence be increased. ABLEX Publishing Corporation.

Chalip, L., & Stigler, J.W. (1986). The development of achievement and ability among Chinese children: A new contribution to an old controversy. Journal of Educational Research, 79 (5), 302-307.

Cooper, D.H., & Speece, D.L. (1988). A novel methodology for the study of children at risk for school failure. Journal of Special Education,22 (2), 186-198.

Dougherty, Thomas M, & Haith, Marshall M. (1993) Relations among manual RT, visual RT, and IQ. 15. ED360041

Flatley, J.K., & Simms, R. (1986). Low-achieving students. The ClearingHouse, 59, 228-230.

Foulks, B., & Morrow, R.D. (1989). Academic survival skills for young children at risk for school failure. Journal of Educational Research, 82 (3), 158-165.

Gardner, H. (1985). Frames of mind. New York: Basic Books, Inc.
Good, T.L., & Brophy, J.E. (1973). Looking in classrooms. New York Harper & Row.

Hawley, W.D.; Rosenholtz, S.J.; Goodstein, H.; & Hasselbring, T. (1984). Good schools: What research says about improving student achievement. Peabody Journal of Education, 61 (4), 1-135.

Jenkins, J.J., & Patterson, D.G., (Eds.) (1961). Studies in individual differences. New York: Appleton-Century-Crafts.

Travers, J.R. (1982). Testing in educational placement: Issues and evidence. In K.A. Heller; W.H. Holtzman; & S. Messick (Eds.), Placing children in special education: A strategy of equity. (pp. 230-261). Washington, D.C.: National Academy Press.

APPENDIX

STUDENT	INTELLIGENCE	PEGBOARD	PURSUIT ROTOR
1	62	122.10	1.87
2	134	45.88	22.81
3	116	57.80	20.90
4	117	60.45	20.52
5	103	128.92	4.44
6	125	54.02	21.20
7	131	63.40	13.97
8	106	63.35	10.05
9	118	62.24	5.93
10	120	87.41	14.23
11	114	58.11	26.04
12	127	53.70	12.90
13	117	60.90	11.80
14	123	55.99	17.03
15	121	53.54	11.70
16	113	55.76	17.97
17	129	55.48	22.30
18	119	53.34	20.62
19	114	51.12	19.53
20	125	63.17	22.65

Full group r-table

	Intelligence	Pegboard	Pursuit Rotor
Intelligence		-.733	.602
Pegboard			-.689
Pursuit Rotor			

Males' r-table

	Intelligence	Pegboard	Pursuit Rotor
Intelligence		-.756	.719
Pegboard			-.776
Pursuit Rotor			

Females' r-table

	Intelligence	Pegboard	Pursuit Rotor
Intelligence		.098	-.097
Pegboard			.185
Pursuit Rotor			