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ABSTRACT

The relationship of particular learning styles and plausible reasoning ability of 110 subjects from 6th, 7th, and 8th grade was examined. Data were compiled on a plausible reasoning test and on a Learning Style Inventory with four subscales: (1) Concrete Experience (CE), (2) Reflective Observation (RO), (3) Abstract Conceptualization (AC), and (4) Active Experimentation (AE). The 7th- and 8th-grade subjects had a significantly higher mean score in plausible reasoning than 6th-grade subjects. A strong positive relationship for female subjects and a strong negative relationship for male subjects existed between CE learning style and plausible reasoning ability. A strong positive relationship existed for male subjects between AE learning style and plausible reasoning ability. (Author/MN)

Kenneth E. Vos

LEARNING STYLE AND PLAUSIBLE REASONING

Inherent in the belief of effective individualized instruction is the assumption that some persons learn in different ways. Unfortunately most individualized programs, especially in mathematics, do not reflect this belief. Instead of promoting different learning paths, the emphasis is placed on the rate of completion coupled with accuracy. In spite of the present emphasis in the curriculum, various education sources(1,2,5) still support the existence of learning styles for many different age groups. It is also agreed that learning style is an individual attribute and the particular learning style exhibited depends somewhat on the instructional setting(5). That is, learning style is a function of the instructional material as well as an individual trait. One such instructional setting could be mathematics and in particular when the mathematics instruction involves inferences, inductive and indirect reasoning. Polys(4) identifies this type of reasoning as plausible reasoning. Plausible reasoning is fluid, does not follow set rules, and is very closely aligned to everyday common sense.

In a study involving mathematics, a degree of this type of plausible reasoning was reflected in good problem solvers as opposed to poor problem solvers(6). Good problem solvers as defined by the Tate study were better able to identify a choice that reflected sound judgment. more caution in selection, less prone to generalize loosely, and less likely to make unreasonable errors. It would seem that the

concept of learning styles and common sense reasoning should be related. This paper considers the relationship of learning styles and plausible reasoning.

Problem

The study was designed: 1)to compare the learning styles of students in a critical development stage of learning, in 6th, 7th, and 8th grades; 2)to consider the relationship of particular learning styles and the ability to reason in a plausible or common sense manner; and 3)to analyze male and female results of learning styles and plausible reasoning ability.

Method

Subjects. The Ss consisted of 110 students in 6th, 7th, and 8th grade. There were 36(20 male, 16 female) 8th graders, 38(18 male, 20 female) 7th graders, and 36(27 male, 9 female) 6th graders. All Ss were enrolled in the same school system.

Instruments and Scoring. Measures were obtained on all Ss from two instruments. Test instruments were a modified version of the Learning Style Inventory(3) developed by Kolb, Rubin and McIntrye and a plausible reasoning test developed by the investigator.

The Learning Style Inventory consisted of nine sets of words. Within each set there were four different word choices. The Ss were instructed to rank order each set of four words assigning a 4 to the word which best characterizes their learning style, a 3 to the word

which next best characterizes their learning style, a 2 to the next most characteristic word, and a 1 to the word which was least characteristic of their learning style. From the inventory four different subscales were obtained:Concrete Experience(CE), Reflective Observation(RO), Abstract Conceptualization(AC), and Active Experimentation(AE). Scoring was done by compiling the rank order totals and the possible range for each subscale was 6 to 24. All Ss were administered the inventory by the investigator in written form within a classroom setting. Each set of words was read aloud by the investigator and then immediately followed by the same words and a synonym for each word. Administration time was 20 minutes.

Later a plausible reasoning test was administered by the investigator in a written format within a classroom situation. the measure consisted of ten statements including a question that required a decision. Each statement had four choices that were plausible or common sense ways of answering the question. Each S had to designate with the numeral 1 the choice that best answers the question. Each S also had to designate with the numeral 2 the next best alternative choice for each question. The example given for explaining the directions to the Ss was the following: When should you wash a car? Choices:Before it rains; After it rains; During a rain; In clear weather. The criterion for constructing a scoring key for this test was developed by the investigator using information from previous administrations of the test(7). A weighted scoring scheme was utilized to obtain a single score for each S. The possible range

for this test was 0 to a perfect score of 40. Administration time was 25 minutes.

Analysis of the data involved means, standard deviations, correlation coefficients, and the t-test. Scores were analyzed by grade level, sex, and learning style subscales results in conjunction with the results of the plausible reasoning test.

Results

The analysis of data by means and standard deviations of the four subscales of the Learning Style Inventory as reported in Table 1 revealed a consistent pattern. The subscales Concrete Experiences(CE) and Reflective Observation(RO) did not yield significant differences on either grade level or sex comparisons. On the Reflective Observation subscale the 6th grade Ss had a higher mean score than both 7th and 8th grade Ss but the difference was not significant. In contrast, both subscales Abstract Conceptualization(AC) and Active Experimentation(AE) did yield significant differences on either grade level or sex comparisons.

Insert TABLE 1

Within the Active Experimentation subscale both the 7th grade ($t(72) = 1.77$, $p < .05$) and 8th grade ($t(70) = 1.76$, $p < .05$) Ss were significantly higher than the 6th grade Ss. In addition, a significant difference($t(45) = 1.87$, $p < .05$) was detected between the 8th grade male Ss and 6th grade male Ss. Male 8th grade Ss had a significantly more active experimentation learning style than the male 6th grade Ss.

Comparison of sex differences within grade levels on the Active Experimentation subscale generated a significant($t(36) = 1.77$, $p < .05$) difference in the 7th grade. The female Ss in 7th grade had a significantly more active experimentation learning style than the male Ss. Within the 6th grade the female Ss also had a more active experimentation learning style but the difference was not significant. Within the 8th grade a reversal occurred, the female Ss no longer had the more active experimentation learning style. The male 8th grade Ss had a more active experimentation learning style but the difference was not significant. Comparison of sex differences within grade levels on the Abstract Conceptualization subscale generated significant differences in both 6th and 7th grade. The female 6th grade Ss had a significantly higher($t(34) = 2.55$, $p < .01$) mean score on the Abstract Conceptualization subscale than the male Ss. Within the 7th grade, a reversal occurred so that the male Ss had a significantly higher($t(36) = 1.85$, $p < .05$) mean score on the Abstract Conceptualization subscale than the female Ss. On this same subscale within the 8th grade, the female Ss had the higher mean score but the difference was not significant.

The analysis of data by means and standard deviations of the plausible reasoning test as reported in Table 2 supported the pattern already examined within the Learning Style Inventory subscales. Consistently the 6th grade Ss scored lower on the Abstract Conceptualization and Active Experimentation subscales as well as on the plausible reasoning test. The 7th grade Ss had a significantly

higher($t(72) = 1.85$, $p < .05$) mean score in plausible reasoning than the 6th grade Ss. Also the 8th grade Ss had a significantly higher ($t(70) = 1.69$, $p < .05$) mean score in plausible reasoning than the 6th grade Ss. In addition, the male 7th grade Ss scored significantly

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Insert TABLE 2

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higher($t(43) = 2.15$, $p < .05$) on plausible reasoning than the male 6th grade Ss. No significant differences were detected when comparisons were made between male and female results within grade levels on the plausible reasoning test.

The relationship between the results of the plausible reasoning test and each of the four subscales of the Learning Style Inventory was analyzed by correlation coefficients. The correlation coefficients are reported in Table 3.

Insert TABLE 3

Significant($p < .05$) negative correlation coefficients occurred only for the Concrete Experience subscale. Male Ss from both the 8th and 6th grade had significant($p < .05$) negative coefficients for this subscale. Female Ss from the 8th grade had a significant($p < .05$) positive correlation coefficient for the Concrete Experience subscale. Within the Reflective Observation subscale, the Ss from the 6th grade had a significant($p < .05$) positive relationship and in particular

the relationship established by the female 6th grade Ss was significant at $p < .01$. Within the Abstract Conceptualization subscale, significant ($p < .05$) positive correlations occurred for total 8th grade Ss, male 8th grade Ss, and total 6th grade Ss. Within the Active Experimentation subscale, the male 7th grade Ss had a highly significant($p < .0005$) positive correlation. In addition, the total 7th grade Ss had a significant($p < .05$) positive correlation coefficient for this same subscale.

A strong positive relationship existed for the female Ss between the Concrete Experience learning style and plausible reasoning ability. In contrast, a strong negative relationship existed for the male Ss between the Concrete Experience learning style and plausible reasoning ability. A strong positive relationship did exist for the male Ss between the Active Experimentation learning style and plausible reasoning ability. Grade level analysis of the relationship of learning styles and plausible reasoning supported positive correlations for 6th grade Ss on the Reflective Observation and Abstract Conceptualization subscales, for 7th grade Ss on the Abstract Conceptualization subscale, and for 8th grade Ss on the Active Experimentation subscale.

Discussion

Proponents of individualized instruction support the concept of learning styles, nevertheless incorporation of learning styles in individualized curriculum development is very meager. One of the reasons for this reluctance to incorporate particular learning styles

in the curriculum is the difficulty in establishing when a certain learning style is most effective and efficient. In addition, learning styles are thought to be heavily dependent on cultural demands placed on both males and females. This present study identified a relationship between particular learning styles and plausible or common sense reasoning. It established a basis for introducing certain learning styles for either males or females in particular portions of the mathematics curriculum.

Limitations of this study necessitate caution in generalizing these results into models of instruction or curriculum development. The validity of both test instruments in detecting particular learning styles or plausible reasoning ability must be examined in more depth before precise classification by either age level or sex is possible. The inventory for learning style only involved four classifications which obviously is not an exhaustive list of ways to learn. Therefore the discussion of the results is very tentative and extreme caution should be exercised in applying the comments to fit any particular bias.

Implications from this study for instructional methods and curriculum development should reflect the consistent pattern of learning styles between age levels and sex. An effective curriculum should emphasize an active experimentation learning style for 7th and 8th grade students and in particular, the emphasis should be greatest for 6th and 7th grade females. If the curriculum or instruction involves plausible reasoning, the emphasis for females should be a concrete experience learning style while the emphasis for males should be an active experimentation learning style. Curriculum

development in plausible reasoning, particularly in mathematics, should reflect the greater plausible reasoning ability of 7th and 8th graders than 6th graders.

Future research in learning styles should establish relationships between particular portions of a curriculum rather than generalized learning styles. The learning style selected by a student may be highly dependent on the instructional material rather than on the individual characteristics of a student. If definite relationships could be established by research between learning styles and concepts being developed in a curriculum, effectiveness of instruction should be evident. This study only established one such relationship, plausible reasoning, but there are many more that future research could detect.

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TABLE 1

LEARNING STYLE INVENTORY

MEANS AND STANDARD DEVIATIONS

Grade / Sex	N	Subscales							
		CE		RO		AC		AE	
		M	SD	M	SD	M	SD	M	SD
8									
M	20	16.30	2.70	12.85	3.12	14.90	3.16	18.05	2.50
F	16	16.25	2.74	12.56	3.41	15.81	2.17	17.69	2.82
Total	36	16.28	2.68	12.72	3.20	15.31	2.78	17.89	2.62
7									
M	[illegible]	15.06	2.96	13.06	4.26	15.78	2.44	17.11	2.40
F	20	15.55	1.93	12.30	3.16	14.25	2.63	18.55	2.61
Total	38	15.32	2.45	12.66	3.69	14.97	2.63	17.87	2.58
6									
M	27	15.96	3.41	13.33	2.99	14.11	3.37	16.59	2.75
F	9	15.22	3.24	12.67	2.06	17.32	2.92	17.38	2.74
Total	36	15.78	3.34	13.17	2.76	14.92	3.52	16.78	2.73

TABLE 2

PLAUSIBLE REASONING

MEANS AND STANDARD DEVIATIONS

Grade / Sex	N	Mean	SD
8			
M	20	22.50	4.83
F	16	23.06	4.54
Total	36	22.75	4.64
7			
M	18	23.61	3.63
F	20	22.10	3.82
Total	38	22.82	3.76
6			
M	27	20.70	4.91
F	9	21.89	3.92
Total	36	21.00	4.66

TABLE 3

PLAUSIBLE REASONING CORRELATED WITH LEARNING STYLE INVENTORY

Grade / Sex	Subscales			
	CE	RO	AC	AE
8				
M	-.43*	+.26	+.45*	+.12
F	+.41*	-.36	+.13	-.02
Total	-.07	-.02	+.34*	+.05
7				
M	-.06	+.01	+.11	+.87***
F	-.02	-.10	-.07	+.08
Total	-.06	-.02	+.07	+.35*
6				
M	-.32*	+.25	+.07	+.28
F	+.28	+.74**	+.42	-.32
Total	-.21	+.30*	+.32*	+.17

*$p < .05$

**$p < .01$

***$p < .0005$