Some Relationships Between Reflectivity — Impulsivity And Learning in Fourth Grade Boys in Kuwait

Qasem A. Al-Sarraf
Dept. of Education of Psychology
Kuwait University

Abstract

The Objective of this study was to determine the relationship between the reflectivity — impulsivity dimension of cognitive style and learning achievement in fourth grade boys in Kuwait.

The hypotheses developed were:

1 — High and low academic achievers will differ on the reflectivity-impulsivity dimension of cognitive style.

2 — Performance for reflective and impulsive children will be situation-specific, depending on the nature of the task .

3 — Impulsive groups will do better on geometric tasks as compared to reflectives, while reflectives will do better on arithmetic tasks.

Sixty-four children classified as reflective or impulsive constituted the experimental sample. Kagan's Matching Familiar Figure Test (MFFT) was employed to assess subjects along the reflectivity-impulsivity dimension. Reflectivity-impulsivity was determined by using total sample median MFF response latency and total sample median MFF error rates. Academic records were used to locate reading and arithmetic achievement in order to determine the relationship between subject style and school achievement. The subjects were also examined on global and detail tasks to determine the relationship between cognitive tempo and specific perceptual tasks. In addition, the groups were given geometry and arithmetic tests to examine discrepancies in performance between reflective and impulsive groups with respect to two related subject areas.

Employing ANCOVA with repeated measures the following results were obtained:

1 — Reflectives spent more time on the global task, followed by the detail task, geometry and arithmetic.

2 — Impulsives committed more errors on the global task, followed by the detail task, arithmetic and geometry.

3 — Considering both groups, differences between reflectives and impulsives were greater on error rates than on latencies.

4 — Reflectives were significantly higher than impulsives in terms of reading and arithmetic achievements for grades 1 through 4,

5 — Reflectives made fewer errors than impulsives on both global and detail tasks. On the other hand, reflectives spent more time and commited more errors on the global than on the detail task.

6 — when compared on the generality and specificity factors, reflectives were superior to impulsives on the generality and specificity factors.

7 — Both reflectives and impulsives took more time on geometry than on arithmetic, and made more errors on arithmetic than on geometry.

The implications of the study are critical for current educational practices in Kuwait, where cognitive styles are not considered a relevant individual difference.

The Study

Method

Subjects. Sixty-four subjects were classified as either reflective or impulsive using Kagan's MFFT. The subjects were chosen from fourth-grade boys representing four different primary schools in four suburban areas of the city of Kuwait, The capital of the state of Kuwait. These four schools were selected at random from among a number of schools in the area. School records were examined to obtain school grades and scores in arithmetic and reading achievements for the last four years of the subject's schooling. These scores consisted of the average final grades assigned at the end of each school year for each subject. This average was based on final grades for arithmetic and reading for which grades were uniformly assigned for all children at all grade levels.

Instruments. Three instruments were used In this study:

1 — Kagan's Matching Familiar Figures Test (MFFT),
2 — a task of twenty global and twenty detail problems, and
3 — a task consisting of ten geometrical shapes and ten arithmetical problems.

The Matching Familiar Figures Test (MFFT) was used to measure the reflectivity-impulsivity dimension (Kagan et al., 1964). This test yields two scores: response latency and error rate. Response latency is the time between the presentation of the MFF item and the subject's first response. The error rate is the subject's choice of an MFF alternative response other than the one identical to the standard. The subject was allowed to make a maximum of five errors on each item. In addition, scores were obtained for each child for the total latency to first response and the total number of errors for the twelve test items. On the basis of response latency and number of errors, classification of a child as reflective or impulsive was attained through median split procedure. Subjects who scored below the median in response latency and above the median in total errors were designated as impulsive. Subjects who scored above the group median in latency and below the median in errors were classified as reflective.

The second instrument consisted of two sets of new MFFT problems developed by the investigator. The first set comprised twenty problems that required global analysis, whereas the second set consisted of twenty stimuli that required analysis of detail. Reliabilities were in the 0,94 , 0.86 for global test, and 0.96 , 0.76 for the detail test, for latency and error respectively.

The study's third instrument consisted of two tasks. The first task contained ten geometrical shapes. The second task included ten arithmetical problems. These two tasks were chosen from local textbooks in order to test generalisability of global and detail tasks. The latency and error reliability coefficients of these tests were 0.41, 0.64, and 0.29, 0.44 for geometry and arithmetic respectively.

Procedure. The three phase of the experiment were carried out in the subjects schools. In the first phase of the study, the subjects were tested individually in an empty room using the Matching Familiar Figures Test (MFFT) as the index of reflectivity-impulsivity. The MFFT consisted of two practice and twelve experimental problems. Each problem included a standard picture of a common object and six variants, one identical to the standard and five differing from it slightly. The subject was asked to look for the variant which matched the standard. The time taken by the subject to make his first choice on each item was the latency score. The number of errors a subject made was recorded as the accuracy score. A week later, the subjects were given two sets of new matching

familiar figures developed by the investigator. The first set consisted of twenty stimuli representing global analysis. The second set included twenty stimuli representing detail analysis. In global problems the difference was shown in the contour of the variants, whereas in detail problems variants differed from the standard in some detail inside the figure. In the third test the subjects were presented with a number of geometrical figures and arithmetical problems separately and one stimulus at a time. These stimuli were chosen from the local texbooks in a way that looked unfamiliar to the subjects, so that all stimuli were new to the subjects.

Prior to the administration of the global, detail, geometry and arithmetic tests, all subjects were given the Wechsler Intelligence Scale for Children (WISC)

Results.

Our initial assumptions postulated an interactive relationship between reflectivity-impulsivity dimension and the nature of the task; i.e. reflective subjects would not be superior to impulsive subjects on all measures of the dependent variables. Rather, we assumed that a given cognitive style might be facilitative in one situation and disruptive in another. Hence interactions rather than main effects dictated our statistical analyses.

t — tests revealed significant differences between reflective and impulsive subjects for both arithmetic and reading criteria, across all grade levels (Tables 1 and 2). The data strongly suggest that reflectives are superior to impulsives in reading and arithmetic achievements across all grade levels.

TABLE I

ARITHMETIC: MEANS AND STANDARD DEVIATIONS FOR GRADES THROUGH 4

Classification	Grade 1	Grade 2	Grade 3	Grade 4
Reflectives				
Mean	76.28	74.44	75.25	67.71
S.D.	14.36	17.52	14.88	18.26
Impulsives				
Mean	55.93	58.59	60.13	55.46
S.D.	17.61	13.69	11.42	13.74
Mean Difference	20.35	15.85	15.12	12.25
t-test	5.06**	4.03**	4.56**	3.03*

*$p \leq .01$. ** $p \leq .0001$.

TABLE 2
READING: MEANS AND STANDARD DEVIATIONS FOR GRADES 1 THROUGH 4

Classification	Grade 1	Grade 2	Grade 3	Grade 4
Reflectives				
Mean	71.90	74.00	71.21	71.37
S.D.	16.35	13.51	15.13	12.56
Impulsives				
Mean	55.62	61.09	59.03	57.81
S.D.	16.30	14.85	12.54	14.25
Mean Difference	16.28	12.91	12.18	13.56
t-test	3.99*	3.64*	3.51*	4.04*

*$p \leq .001$.

Mean latency and error for reflective and impulsive groups on global and detail tasks revealed that reflectives took longer time and made fewer errors on both tasks. In addition, both groups spent less time on solving detail task than on solving the global task (Table 3).

TABLE 3
MEAN LATENCY AND ERROR FOR R-I GROUPS ON GLOBAL AND DETAIL TASKS

	Groups	Global	Detail
R	Latency	.68	.64
	Error Rates	—.59	—.58
I	Latency	—.68	—.64
	Error Rates	.59	.58

In order to further examine differences between reflective and impulsive groups with respect to the nature of the task, we restructured our four regular tasks into two construct factors: a generality factor consisting of global plus detail (G1) and arithmetic plus geometry (G2), and a specificity factor consisting of detail plus arithmetic (S1) and global plus geometry (S2). The rationale for this division was that alternative explanations were needed to decide upon the discrepancy in performance between reflective and impulsive groups. ANCOVA, using age and IQ as covariates, was performed for latency and error rates across generality

and specificity. Table 4 revealed a significant difference between the impulsive and reflective groups with respect to latency.

TABLE 4

ANCOVA: LATENCY ACROSS GENERALITY AND SPECIFICITY FACTORS

Source	SS	DF	MS	F
Mean	1.15	1	1.15	.90
Ref. vs. Imp. (R)	55.58	1	55.58	43.87*
I.Q.	1.84	1	1.84	1.45
Age	.32	1	.32	.25
Error	76.03	60	1.27	
Specificity (S)	.00	1	.00	.00
S X R	.38	1	.38	.76
Error	31.28	62	.50	
Generality (G)	.00	1	.00	.00
G X R	9.04	1	9.04	11.79*
Error	47.56	62	.76	
G X S	.00	1	.00	.00
G X S X R	.13	1	.13	.29
Error	28.8262	62		

*$p \leq .001$.

However, no main effect for the generality factor was found. Rather there was a significant generality by group interaction both in terms of latency ($p < .001$) and error rates ($p < .10$). This interaction indicates that reflective subjects are superior to impulsive subjects on type of task (detail plus global) versus type of subject matter (arithmetic plus geometry). Table 5 Suggests a significant group difference in terms of error rates ($p < .10$) between impulsive and reflective groups on the generality factor. No counterparts were found for specificity.

The mean latency and error rates for both groups on geometry and arithmetic were also reported (Table 6). Reflectives made fewer errors on both tasks than their impulsive counterparts. Also, the difference between impulsives and reflectives in error rates was greater on arithmetic than on geometry.

TABLE 5

ANCOVA: ERROR RATE ACROSS GENERALITY AND SPECIFICITY FACTORS

Source	SS	DF	MS	F
Mean	1.39	1	1.39	1.01
Ref. vs. Imp. (R)	47.88	1	47.88	34.90**
I.Q.	4.34	1	4.34	3.16
Age	.03	1	.03	.02
Error	82.31	60	1.37	
Specificity (S)	.00	1	.00	.00
S X R	.86	1	.86	1.59
Error	33.68	62	.54	
Generality (G)	.00	1	.00	.00
G X R	1.96	1	1.96	3.63*
Error	33.56	62	.54	
G XC S	.00	1	.00	.00
G X S X R	.98	1	.98	2.04
Error	29.80	62	.48	

*p ≤ .10.
**p ≤ .001.

TABLE 6

MEAN LATENCY AND ERROR FOR R-I GROUPS ON GEOMETRY AND ARITHMETIC

	Classification	Geometry	Arithmetic
R	Latency	.35	.22
	Error Rates	—.30	—.53
I	Latency	—.35	—.22
	Error Rates	.30	.53

In addition, comparisons between groups were made for geometry versus arithmetic both in terms of latency and error rates. Although differences emerged between the means for reflective and impulsive groups (.35 versus — .35 for Geom (L), — .30 versus .30 for GEOM (E), and .22 versus — .22 for Arith (L), — .53 versus. 53 for Arith (E), for reflectives and impulsives respectively), these differences were not significant in terms of interaction effect F (1,62) = .61 p ≤ .43 for GEOM (L) versus

ARITH (L), and F (1,62) = 2.30, $p \leq .13$ for GEOM (E) versus ARITH (E). These results suggest that the performance of reflectives is superior to that of impulsives across all four tasks. This superiority is demonstrated by interaction effects among the impulsives— reflectives across the generality and specificity factors.

Discussion

The data revealed a significant relationship between the impulsivity-reflectivity dimension and school academic achievement, supporting results of earlier investigations (Cathcart and Leidtke, 1969; Wesser, 1970; Barett, 1977; Englehardt, 1978; Tabeleff, 1978). Across both reading and arithmetic, impulsive children were consistently lower achievers than their reflective peers. In fact, of the 32 impulsive subjects in our sample, 16 had failed their classes for at least one year. The reflective sample, on the other hand, showed that two had failed their classes (primarily in reading) for only one year. Of the two reflectives who had failed, reading achievement was the main factor. In contrast, impulsives failed in both arithmetic and reading achievements. Of the 16 impulsive subjects who failed their classes, 11 failed for one year, three for two years, and two for three years. These findings are consistent with Hypothesis one, in that high-achieving subjects tended to include more reflectives than low-achieving subjects did.

The study yielded no significant interaction effects between reflective and impulsive groups and global versus detail tasks. Although reflectives performed better than impulsives on both these tasks, the discrepancy between the two groups' performance was greater on the global than on the detail task. When the two groups were compared on the number of errors for both tasks, reflective subjects proved to be more accurate than their impulsive counterparts. Although the performance discrepancy between reflectives and impulsives on the global versus detail tasks was not significant, the error measure indicated that reflective children were superior to impulsive children on both the global and detail tasks, that is, they were more accurate and committed fewer errors than their impulsive peers. Thus, as far as accuracy is concerned, reflectives seemed to be more successful and efficient than impulsives. These results did not concur with the findings of Zelniker and Jeffrey (1976) who found that impul-

sive children are superior to reflective children on a global task. It appears that this finding may be unique in terms of the general pattern of research results. Interaction effects for reflectivity — impulsivity and the generality and specificity factors were also determined in this study. No pattern of significant interaction effects was demonstrated between impulsivity and reflectivity, except for impulsivity-reflectivity and the generality factor. The data did not support the hypothesis of a differential performance between impulsive and reflective children depending on the nature of the task.

The hypothesis that impulsive groups would do better on geometric tasks as compared to reflectives, while reflectives would excel on the arithmetic task was not supported. Compared for number of errors on the arithmetic and geometry tasks, reflectives proved to be somewhat better on both tasks. Conversely, Impulsive subjects were less accurate, committing more errors on arithmetic than on geometry. When compared to the amount of time spent solving both tasks, both groups took more time to solve geometrical than arithmetical problems. Interestingly, more errors were made on the arithmetic task. The reason for this apparently contradictory result is that the modern math curriculum recently introduced in primary schools in Kuwait has puzzled many children and teachers alike. The modern math approach was intended to make the primary school children better convergent thinkers, but the data from this study indicates that the subjects have become poorer divergent thinkers, especially impulsives. Klein et al. (1976) assert that there is a close relationship between the reflectivity-impulsivity dimension of cognitive style and convergent problem-solving ability, whereas there is no relationship between the reflectivity-impulsivity dimension and divergent problem-solving ability. These findings need to be replicated

The within-Task comparisons showed no significant style X subject matter interaction, i.e. reflectives performed better than impulsives on both arithmetic and geometry tasks. Thus, when task accuracy was crucial, reflectives were superior to impulsives.

The most important question raised by this data concerned the performance of impulsive subjects; i.e., the failure to demonstrate superiority to reflectives on the global, geometry, or MFF tests. This question needs to be further investigated. One possible explanation lies in an examination of the impulsive subjects test protocols. Their relatively low performance on these tasks was in part due to the strategies employed. Of the

32 impulsive subjects, 18 relied heavily on guessing the correct answers to the MFF tests. They did not efficiently employ a strategy that eventually led them to reach a correct decision. Often they simply looked at the stimuli and immediately responded without going over the pictures. Conversely, reflective subjects displayed more flexibility by using strategies that took into account the demands of the task. These analyses suggest a relationship between reflectivity-impulsivity and divergent problem-solving, contradicting findings of klein et al. (1976). The MFF involves a maximal reliance on perception. The absence of a conceptual tempo X task interaction in terms of error rate suggests that the difference was due more to processing strategies than item difficulty. The fact that impulsives made more errors on both the global and geometry tasks also suggests the use of inefficient strategies.

It may be argued that reflective children process information differently as compared to their impulsive counterparts. Reflectives not only used the more efficient strategies, but aslo dealt more effectively with problems of divergence, in part through the longer time spent on solutions. The data did not show reflectives taking less time on the global than on the detail task, because the detail task was more laborious and difficult. Reflective subjects looked more often and longer at the standard and its variants than did the impulsive subjects. This finding was also reported by Siegelman (1969) and Drake (1970). One speculation as to why the reflective subjects took more time and committed more errors on the global than on the detail task is that the global task may have been incompatible with the search strategy they utilized. The fact that reflectives committed fewer errors on both the global and detail as well as the geometry and arithmetic tasks, also suggests that reflectives were somewhat more adaptable to the nature of the task than their impulsive counterparts; e.g. number of potential solutions to a problem. As for the impulsive group, it might be reasonable to suggest that the impulsive strategy depended more on guessing rather than on scrutinizing (i.e., analyses). Regardless of task, our findings indicate that impulsives used inadequate and / or inappropriate strategies.

However, studies with larger and more broadly based samples than those reported in this study are needed to determine whether the tasks utilized (global, detail, arithmetic, and geometry, together with reading and arithmetic achievement) are comprehensive enough to predict relationships between conceptual tempo and achievement performance in academically successful and unsuccessful children.

References

Barrett, D. «Reflection-Impulsivity as a Predictor of children's Academic Achievement.» **«Child Development,** 1977, **48,** 1443 — 1447.

Cathcart, G., and Liedtke, W. «Reflectiveness/ Impulsiveness and Mathematics Achievement,» **Arithmetic Teacher,** 1969, **16,** 563 — 567.

Drake, D. «Perceptual Correlates of Impulsive and Reflective Behavior.» **Developmental Psychology,** 1970, **2,** 202 — 214.

Engelhardt, J. «Cognitive Style and children's Computational Errors.» **Perceptual and Motor skills,** 1978, **46,** 323 — 330

Finch, A. Pezzulti, K., Montgomery, L. and Kemp, S. «Reflection-Impulsivity and Academic Attainment in Emotionally Disturbed children.» **Journal of Abnormal Child Psychology, 1974 2,** 71 — 74.

Hallahan, D., Kauffman, J., and Ball, D. «Selective Attention and Cognitive tempo of low Achieving and high Achieving Six Grade Males.» **Perceptual and Motor Skills,** 1973, **36,** 579 — 583.

Kagan, J., Rosman, B., Day, D., Albert, J., and Phillips, W. «information Processing in the child: Significance of Analytic and Reflective Attitudes.» **Psychological Monographs,** 1964, **78,** (Whole No. 578).

Klein, G., Blockvich, R., Buchalter, P., and Huyghe, L. «Relationship Between Reflection-Impulsivity and Problem Solving.» **Perceptual and Motor Skills,** 1976, **42,** 67-73.

Messer, S. «Reflection - Impulsivity: Stability and School Failure.» **Journal of Educational Psychology,** 1970, **61,** 487-490.

Nuessle, W. «Reflectivity as an Influence on Focusing Behavior of Children.» **Journal of Experrimental Child Psychology,** 1972, **14,** 265 — 276.

Siegelman, E.«Reflective and Impulsive Observing Behavior.» **Child Development,** 1969, **40,** 1213 — 1222.

Tebeleff, M. «Reflectivity-Impulsivity as a Correlate of Reading and math Achievement in 7, 9, and II Year Old Children.» **Dissertation Abstract International,** 1978, **39,** (II - B), 5603.

Zelniker, T., and Jeffrey, W. «Reflective and Impulsive Children: Strategies of Information Processing Underlying Differences in Problem Solving.» **Monographs of the Society for Research in child Development,** 1976, **41** (Whole No. 5).