
A Look at Cognitive Tempo: Review With Commentary

Adinew Husien*

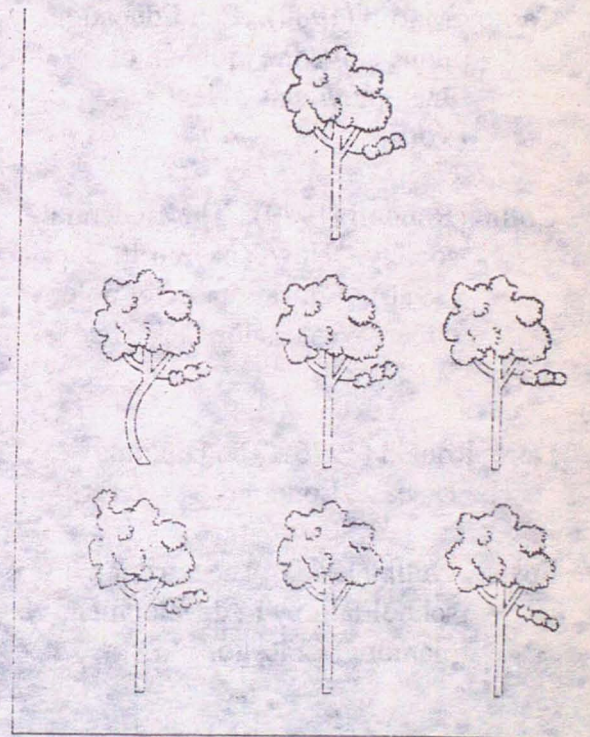
There are various cognitive profiles that may reveal themselves in one's personality, social and intellectual functionings. These include field dependence-independence, focus-nonfocus (scanning), cognitive complexity-simplicity, broad-narrow (breadth of categorization), leveling-sharpening, tolerant-intolerant, and reflectiveness-impulsivity (Letteri, 1980).

The reflectiveness-impulsiveness dimension or cognitive tempo refers to a child's tendency to respond slowly or rapidly in a problem solving situation which has high uncertainty. Reflective and impulsive were terms used by Kagan and associates in 1964 to refer to two types of information processing modes among children. Who is a reflective child and who is an impulsive one? The identification of the two groups of children is based upon performance scores on a match-to-standard perceptual recognition task called MFFT.

The Matching Familiar Figures (MFF) Test

This test is designed in such a way that it elicits responses from the testee which implicate error in choice and delay in time. The test contains usually 12 items as well as some practice items. Each item represents different types of

pictures of familiar objects. An item has one standard (or sample) picture and similar variants only one of which is identical to the standard. A typical MFFT item looks like the following.



After Kagan developed one form of the test with two levels: elementary (ages 11-12), and adolescent/adult (ages 13 and over) in 1966 (see Mitchell, 1985:90) two additional forms were later developed. As mentioned by Egela and Weinberg (1976) the second version identified as Form B (developed by Kagan, Pearsin, & Welch in 1966) is restricted

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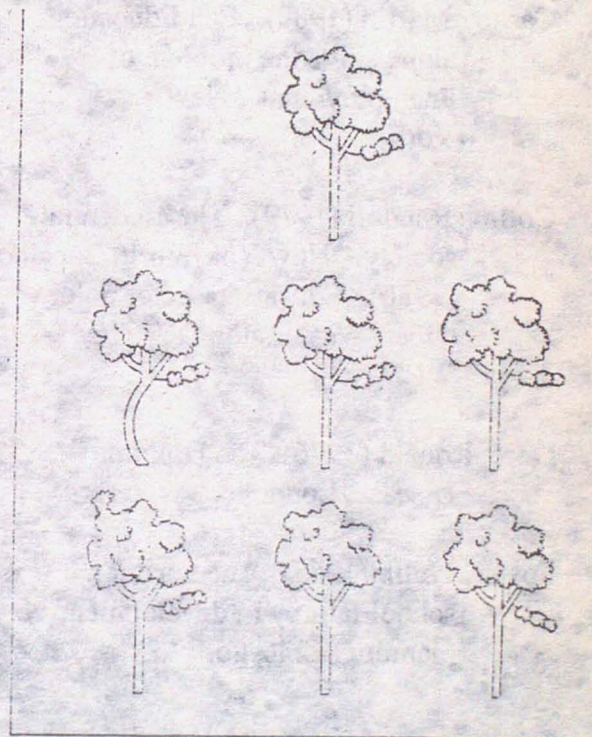
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for use as a post test measure in pre-post test design while the third one Form K (constructed by Yando & Kagan in 1968) is the younger children's version, perhaps for use in studying kindergartners.

In any form one finds a standard and its variants. The number of variants to be compared to the standard sample may range between two and eight. The complexity of details and number of variants differ depending most on the age group of the testees. Preschoolers, for instance, may be presented the form of the test with the fewest details and smallest number of stimulus array, say four.

The test is individually administered. The testee is asked to indicate the variant which is identical to the standard. The examiner records two variables: error and latency. Using a stop-watch, he/she registers the time the testee has taken to produce the first response and also marks wrong when the first response of the individual testee is incorrect. Error scores and response latency (in seconds) are combined to determine an individual's cognitive tempo. Single median split is applied to label individuals as reflective or impulsive. Those testees who scored below the median on error scores and above the median on latency are reflectives, whereas those who scored above the median on errors and below it on latency are impulsives. At times double median split is used to identify further two sub-labels. When this is the case, fast accurates and slow inaccurates are found. In addition to the previous two groups (e.g. Ault, Crawford, and Jeffrey (1972); and Egeland & Weinberg, 1976).

Psychometric Evaluation of the MFFT

As described in Mitchell (1985), the Matching Familiar Figures Test lacks data on reliability and validity. Even norms are provided only for the elementary (5-12 years) version. It has no manual though directions for administering are provided.

Nevertheless, Kagan and his colleague reported some reliability evidences especially for response time on MFFT performance. Citing some studies (e.g. Yando, 1968; and Messer, 1968) which used different elementary grade level children, MFFT versions and test-retest time span, Kagan and Kagan (1970:1310) reported moderate to high indices of correlations. Specifically, the correlations for response time were reported to be .70 (across 10 weeks), .62 (over a year) averaged for both sexes, and .48 for boys and .52 for girls (again over a year). However, the stability was rather weak over a period of two and half years indexing only .31 (Kagan & Kagan, 1970). The same authors also forwarded evidences for the consistency of reflection-impulsivity disposition across a variety of tasks. Kagan and Kagan (1970:1310) claimed that "The correlations between response time on the Matching Familiar Figures task and response time on a Haptic-Visual Matching task were consistently high across many samples of children in the first grades." They displayed correlation indexes, evincing evidences on generality of the task in the child's ability to generate own's alternative hypothesis and temporal delay to respond interview questions as well as the previously mentioned visual task. While these three instances may be taken as warranting some convergent validity of the MFFT, its failure to correlate with

the verbal subscale of the Wechsler Intelligence Scale for Children (see Kagan and Kogan, 1970) points to the tendency of the test to bear divergent validity. Support for this contention was also found in the Psychometric study by Ozawa and Michael (1983). On the other hand, Gow and Ward (1982) showed MFFT to be no better contributor in predicting the work performance of moderately-severely retarded trainees.

There were some recent efforts to determine the psychometric credibility of the MFFT. For instance Egeland and Weinberg (1976) substantiated the internal-consistency of the test at least on response latency variable. Zelinker and Jeffrey (as reported in Dillion and Donow, 1982) modified the MFFT in 1976. According to Dillion and Dinow (1982: 530) the items in the Zelinker and Jeffrey version of the MFFT "are divided into four categories. One half of the items requires global analysis; the other half an analysis of detail. One half of each of the global and analytical items comprises abstract figures that are not easily labeled; the other half consists of meaningful, concrete Figures." The modified Matching Familiar Figures (MMFF) test has 28 items.

Dillon and Donow (1982) after evaluating this modified version reported promising results. Comparing the MMFF scores with a figure-analogy test, namely, the Advanced Progressive Matrices as well as some standard achievement measures among 169 college samples, they found an improved internal consistency and stability. As to the construct validity of the MMFF as a measure of cognitive style, no supporting data was found (Dillon and Donow, 1982). In a theoretical note by

Laine (1982), MFFT was labeled as a measure of product variable while cognitive tempo is a process-oriented construct. Others (e.g. Gjerde, Block and Block, 1985; and Block, Gjerde and Block, 1986) have strong allegation. Not only such researchers were devoid of faith in the MFF test, but they also claimed the existence of "competence" rather than conceptual tempo. Nevertheless, a more dependable work was done about the methodological problems in cognitive temper research early by Ault, Mitchell, and Hartman. Their workers after reviewing researches previously done, and applying an advanced statistical analysis intended that the MFFT has validity demonstrated over various cognitive development tasks. Suggesting investigators to be more careful in interpreting data generated through MFFT, Ault, Mitchell and Hartman (1976:230) concluded that "use of larger sample sizes, adequate research designs, and appropriate statistical analyses makes it possible to continue to work with the test in its present form."

The Features of cognitive Tempo

The disposition to be impulsive or reflective is stable across tasks, consistent over time, and modifiable (Kagan, Person, & Welch, 1966; Schwab, 1973; Hetherington and Park, 1986). Reflection-impulsivity was also related to differences in problem solving strategy, attention span, social interaction and some behavior pathologies (Kagan and Kogan, 1972; Adams, 1972; Reid, 1975; Lawry, Werry & Jeffrey, 1983; and Hetherington Parke, 1986).

The disposition revealed differential functioning among the two groups.

Reflectives have been labeled superior in various intellectual tasks (Messer, 1970; Schwab schruab, 1973 and Barrett, 1977) because they tended to apply more advanced strategies (Ault, 1973), scan stimuli more carefully and systematically (Yap and Peters, 1985) and have more comparison glances (Katz, 1970) than their impulsive counterparts.

In investigating group differences between impulsives and reflectives, some researchers (e.g. Mitchel & Ault, 1977) related cognitive tempo to detailed versus global scanning strategies. These researchers administered a pattern Matching-Standard covered task as well as the MFFT to 94 children between the ages of eight and 12. Their data demonstrated that increased latency (reflectivity) was correlated to a detailed scanning strategy.

Other line of research showed that cognitive tempo interacting with socio-economic status brought about a differential performance effect on four Wechsler Intelligence Scale for Children-Revised (WISE-R) subtests. In this regard Walker (1985) found that middle-SES reflectives out scoring low-SES impulsives on such intelligence measures. Attention span deficits were also reported by other authors (Siegelman, 1969; and Zelniker, Jeffrey, (21686) and Parsons, 1972). There were 2120 intly consisten researches (Kagan 1970a; Messer, 1970; Ault, Mitchell and Ault, 1977; Barrett, (1985) and Lopper & Hollahan, 1979) identified cognitive tempo as vital for or of some core areas of educational performance. Exceptions to these include studies by Stenberg et al. (1982) and Carroll (1977) who did not

find relations between conceptual tempo and school performance.

The most frequently mentioned and that demonstrated well cognitive variations between the two cognitive tempo groups included visual discrimination tasks, serial recall, inductive reasoning and (prose) reading (Kagan and Kogan, 1970; and Ault, 1973): the get better of being attributed to reflective tempo in each of these tasks. In Hetherington and Parke (1986) some studies are cited which showed reflectives still being superior in Piagetian measures of conservation and formal operations. Impulsives were also found to have underestimated time intervals more than reflectives (Walker, 1982).

Indeed, "greater impulsivity has been observed in children with reading difficulties, learning disabilities, and who experience school failure" (Yap and Peters, 1985: 1055). Moreover, Wyatt and Fulton (1987) observed impulsive committing more errors in computer learning. Other authors, (like Ault et al., 1972) who identified four tempo groups, reported that reflectives and fast-accurate as compared to impulsives and slow in accurate were more systematic and made greater standard to variant comparisons. Does cognitive tempo relate to intelligence measures? The answer is virtually no. Although correlational tendencies were reported between tempo and IQ measures (Hetherington and Parke, 1986), the indexes were not as such substantial (Lawry, Welsh, & Feffrey, 1983). Whenever relationship existed, it was only with some part or subtests of the traditional measures of intelligence, for example, the attention-concentration and visual organization subtests of the WISC-R (Lawry, Welsh,

and Jeffrey, 1983) and was higher for girls than for boys (Hetherington and Parke, 1986).

There have been attempts to investigate the role of cognitive tempo in non-problem-solving situations. For instance, Davidson (1982) examined impulsivity and field-dependence (another type of cognitive style dimension) both as cognitive and personality styles. His results did not confirm any type of relationship between the two cognitive style dimensions. Similarly, Agnew and Young (1979) did not find data to support their hypothesis that hyperactivity and impulsivity are related. Another study by Victor, Halverson, and Montague (1985) demonstrated that behavioral impulsivity were rather attributed to activity level than to cognitive tempo.

Such results pose deleterious effect upon the premise that cognitive tempo (like any other cognitive styles) function reveal itself in one's cognitive as well as personality functioning.

The last point may consequently lead to the dynamics of reflection-impulsivity. What is the prime-mover behind the information-processing tempo?

So long as the segregation as impulsive or reflective hinges on MFFT performance scores, the operating function seems anxiety. Kagan and Kogan (1970) provided two different explanations for the psychological bases of this disposition. These were motive and anxiety. According to them, the motive to appear competent as well as the fear of making a mistake may prompt differential disposition. To begin with, the motive to appear competent may breed anxiety. The source of anxiety,

however, is deemed to be different for the two groups. According to, Kagan and Kogan (1970:1314) "For the reflective, the source of anxiety derives from the expectation that the social environment will regard the person as incompetent because he has made a mistake." On the other hand, "For the impulsive, the source of anxiety derives from the expectation that he will be judged incompetent if he responds too slowly." Such explanations rather seem speculative. Because a child who responded quickly may, for instance, thought of maximizing his/her praise by appearing fast respondent granting the answer was correct. Infact, the following alternate explanation appear to be more cogent. Their acclaimed dynamic read " that the greater the fear of making a mistake, the more reflective and cautious the performance. Minimal anxiety over a potentially inaccurate answer is likely to be a primary determinant of an impulsive performance" (Kagan & Kogan, 1970: 1314). If these hold true, the pressure from primary socializing agents cannot be relegated to minor influence in the development of cognitive tempo. In fact, mother's role was emphasized in some studies (e.g. Mckim, 1979). Peer groups and teachers inevitably take on importance later on. Teachers can affect dramatically the child's emerging te as evidenced by Yando and K (1968). These authors confirmed experienced reflective teachers effect greater increase in response time an their students.

The issue of whether it is anxiety over-errors or anxiety-over-competence that prompted the disposition to be impulsive or reflective has been debatable. In this respect, Yap and Peters(1985) provided evidence that supported the anxiety-

over-errors hypothesis. The same researchers concluded that impulsive behavior may stem from a lack of motivation to perform well. A contradictory result was reported earlier by Messer (1970b) who experimentally induced failure among his experimental group. His data favored the anxiety over intellectual performance proposition as the antecedent of cognitive tempo. This finding was replicated by Weiner and Adams (1974).

III. Modifying Cognitive Tempo: (Strategies and Limitations)

The development of the reflection-impulsivity disposition as following some pattern was utterly stated by Carroll (1977) and Okum and colleagues (1979). Likewise, Salkind and Kojima (1977) as well as Salkind and others (1978) showed that the disposition is cross-culturally universal.

A number of authors corroborated the modifiability of cognitive tempo (e.g. Kagan, Pearson, & Welch, 1966; Denney, 1972; Zelniker, Jeffrey, Ault and Parsons, 1972; Schwab, 1973; Sola and Phye, 1975; Genshaft, and Hirt, 1979; Walker, 1981; Learner and Richman, 1984; Kurtz and Borkowski, 1985; and Hetherington and Parke, 1986).

Most studies which attempted to modify cognitive tempo have hitherto focused on impulsives. This partial treatment seems partially reasonable because of the fact that impulsives might be perceived by teachers as socially and intellectually incompetent (e.g. Gullo, 1988). The emphasis upon impulsives might have been based on the assumption that when latencies are increased errors will decrease as a consequence.

At any rate researchers have employed different modalities to modifying impulsivity. The major modalities included (i) time delay, (ii) strategy training, and (iii) modeling (Hetherington and Parke, 1986; and Schwab, 1973). As reviewed by Schwab (1973:2) "teaching specific strategies such as 'cue relevance' and scanning strategies appear to be more consistently effective than training for delayed response alone." A pronouncing evidence for this point emerged from Zelniker, Jeffrey, Ault, and Parsons' (1972) study. These researchers used a task called Differentiating Familiar Figures (DFF) to modify the scanning strategies of 9-year-old children. The DFF employed in Zelniker et al's (1972) study required a subject to find the variant that was different from the standard. On this task, both reflectives and impulsives showed a decrease in percentage of eye fixations on the standard and an increase in systematic comparisons of the variants. From the data of the study, it was demonstrated that the modified strategy transferred to an MFF task for impulsives only. In a recent study by Walker (1981), forced delay significantly improved scoring of impulsives on WISC-R subtests. As regards modeling, different interfering factors were identified. Some studies (e.g. Genshaft and Hirt, 1979) revealed racial similarities of models as effecting selective changes in impulsivity, others like Denney (1972) showed a model with different styles and tempos to be effective.

Most attempts to modify tempo were successful among impulsives. Yet, the success at times failed to generalize

across tasks, especially in terms of error reduction.

General Commentary

The reflectivity-impulsivity disposition pervades itself to be an important construct to be checked by educators. This cognitive profile dimension should be of peculiar interest to preschool as well as elementary school teachers. When teachers understand that students in the classroom differ in their tempo of information processing, they will be aware of the strategic limitations of impulsives, consequently, given the skill, they may help individual learner modify his/her tempo in the desired direction.

Such endeavor is of paramount importance in the school setting since cognitive tempo has been indicated to be responsible for a substantial proportion of school performance. Similarly different dimension of tempo styles has also been observed to elicit differential treatment from teachers. The educational implication was even extended to the design of social study books (e.g. Martorella, 1979).

To counterbalance the group differences, the resort is towards modifying the usually disadvantaged disposition namely, impulsivity. Yet the following points should be considered if intervention is to be sought:

- (i) Whether there are critical ages for modifying a cognitive tempo; such researchers as Barstis and Ford (1977) suggested the early school years.
- (ii) Whether tasks with different nature and context require different tempo of information processing, is reflectivity always important? could fast-accurate style be effected?

- (iii) Whether one type of modification training is always superior to other; or combination of modalities could be efficacious.

Another important issue in the construct of cognitive tempo is the measure itself. The MFFT has been a device for segregating individuals into the two types of disposition. This measure though demonstrated some internal consistency, its lack of validity data calls for improvement. Points of venture in the refinement of MFFT may include:

- improving the reliability of the error variable;
- finding alternate way of administering the test; a case in point is the presence of a stop-watch which can pose a time pressure on the testee thus influencing performance (See: Quay, Popkin, Weld, and McLeskey, 1978). A hidden time (or latency) register should be devised so that subjects will not emphasize quick responding exclusively at a risk of incorrect responding.
- Using the measure for cross-cultural research seem unfeasible. Even though some items (e.g. tree) are familiar in most cultures, other items in the MFFT (e.g. telephone box) may not be universally familiar. Hence, adaptation is in order to make it a culture fair measure.

Research Implications

Hitherto most notable researches focused on group comparisons between impulsives and reflectives. Since the intelligence measure frequently has been that of Wechsler. It is interesting to relate MFFT data to scores on other intelligence scales to see if different results could be procured.

Also of interest is the segregation of subjects into groups. A greater number of research designs divided participants into impulsives and reflectives by using single median split. A few, however, divided their subjects into four groups (fast accurate and slow inaccurate as well as the former two) following double median split. In this respect, researchers may look at even to finding further groups, say, moderate impulsives and moderate reflectives. Such further segregation must, nevertheless, be accompanied by within group comparisons design, thus, if differences exist between them this suggestion may operate. Otherwise, rationale must be provided to segregating subjects into two groups.

The Raven's standard progressive Matrices (SPM) were preferred by many researchers as a problem solving task in comparing the scores of individuals on MFF test. In fact the SPM was described as having a similar format with the MFFT. Since in the SPM "a subject is shown an incomplete matrix

and asked to select the missing piece from several simultaneously presented alternatives, it is believed that there is a fair degree of response uncertainty and little reliance on verbal skills" (Lawry, Welsh, and Jeffrey, 1983: 913). While the present reviewer accue with this point, it seems imperative to compare MFFT performance with other standard achievement tests as well as the Raven's tests. To sum up, the present review and commentary was based upon researches conducted from the 1964 to the late 1980's. Thus, the review lacks developments beyond that time range due to inavailability and/or inaccessibility of sources in the mentioned time range. Nevertheless, this review will be of vital resource of review for researchers interested in the theme of cognitive tempo.

REFERENCES

- Adams, W.V. (1972). Strategy Differences Between Reflective and Impulsive Children. Child Development, 43(30), 1076-1080.
- Agnew, P.N. & Young, R.D. (1979). Verbal Mediation, Cognitive Tempo, and Self-Esteem in Normal-Active, High-Active and Hyperactive Boys: [A.A.U. CD-ROM]. Abstract from: ERIC: ED 172915.
- Ault, R.L. (1973). Problem-Solving Strategies of Reflective, Impulsive, Fast-Accurate, and Slow-Inaccurate Children. Child Development, 44(2), 259-266.
- Ault, R.L.; Crawford, D.E. & Jeffrey, W.E. (1972). Visual Scanning Strategies of Reflective, Impulsive, Fast-Accurate, and Slow-Inaccurate Children on the Matching Familiar Figures Test. Child Development, 43(4), 1412-1422.
- Ault, R.L.; Mitchell, C. & Hartmann, D.P. (1976). Some Methodological problems in Reflection-Impulsivity Research. Child Development, 47(9), 227-231.
- Barrett, D.E. (1977). Reflection-Impulsivity as Predictor of Children's Academic Achievement. Child Development, 48(4), 1443-1447.
- Barstis, S.W. & Ford, L.H.Jr. (1977). Reflection-Impulsivity Conservation, and the Development of Ability to control Cognitive Tempo. Child Development, 48(3), 953-959.
- Block, J.; Gjerde, P.f. & Block, J.M. (1986). More Misgivings About the Matching Familiar Figures Test As a Measure of Reflection-Impulsivity: Absence of Construct Validity in Preadolescence. Developmental Psychology, 22(6), 820-831.
- Carroll, J.A. (1977). The Effects of Cognitive Tempo on Cue Selection Strategies of Young Children. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 242436.
- Davidson, W.B. (1982). Multimethod Examination of Field-Dependence and Impulsivity. Psychological Reports, 50(2), 655-661.
- Denney, D.R. (1972). Modeling Effects Upon conceptual Style and Cognitive Tempo. Child Development, 43 (1), 105-119.
- Dillon, R.F. and Donow, C. (1982). The Psychometric Credibility of the Zelniker and Jeffrey Modification of the Matching Familiar Figures Test. Educational and Psychological Measurement, 42(2), 529-536.
- Egeland, B. & Weinberg, R.A. (1976). The Matching Familiar Figures Test: A Look at Its Psychometric Credibility. Child Development, 47(2), 483-497.

Genshaft, J.L. & Hirt, M. (1979). Race Effects in Modifying Cognitive Impulsivity through Self-Instruction and Modeling. Journal of Experimental Child Psychology, 27(1), 185-194.

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Gardner, P.F.; Block, J. & Block, J.H. (1985). Longitudinal Consistency of Matching Familiar Figures Test Performance from Early Childhood to Preadolescence. Developmental Psychology, 21(2), 262-271.

Gow, L. & Ward, J. (1982). Extension of the Use of Measures of Cognitive Style to Moderately-Severely Retarded Trainees in a Field Setting. [A.A.U. CD-ROM]. Perceptual and Motor Skills, 55(1), 191-194. Abstract from: ERIC: EJ 269301.

Gulo, D.F. (1988). An Investigation of Cognitive Tempo and Its Effects on Evaluating Kindergarten Children's Academic and Social Competencies. [A.A.U. CD-ROM]. Early Child Development and Care, 34, 201-215. Abstract from: ERIC: EJ 385959.

Hetherington, E.M. & Parke, R.D. (1986). Child Psychology: A Contemporary View Point. 3rd ed. New York: McGraw-Hill Book C.

Kagan, J. & Kogan, N. (1970). Individual Variation in Cognitive Processes. In P.H. Mussen (Ed.) Carmichael's Manual of Child

Psychology, 3rd ed. Vol. II, 1306-1319.

Kagan, J.; Pearson, L. & Welch, L. (1966). Modifiability of an Impulsive Tempo. Journal of Educational Psychology, 57(6), 359-365.

Katz, J.M. (1971). Reflection - Impulsivity and Color-form Sorting. Child Development, 42(3), 745-754.

Kurtz, B.E. & Borkowski, J.G. (1985). Metacognition and the Development of Strategic Skills in Impulsive and Reflective Children. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 257572.

Laine, M. (1982). Theoretical Note on Reflection Impulsivity. Psychological Reports, 51(1), 84.

Lawry, J.A.; Welsh, M.C.; & Jeffrey, W.E. (1983). Cognitive Tempo and Complex Problem Solving. Child Development, 54, 912-920.

Lerner, K.M. & Richman, C.L. (1984). The Effects of Modifying the Cognitive Tempo of Reading Disabled Children on Reading Comprehension. [A.A.U. CD-ROM] Contemporary Educational Psychology, 9(2), 122-134. Abstract from: ERIC: EJ 2989578.

Letteri, C.A. (1980). Cognitive Profile: Basic Determinants of Academic Achievement. The Journal of

Educational Research, 73(4) 195-198.

Loper, A.B. & Hallahan, D.P. (1979). The Relationship of Cognitive Tempo to Achievement in LD Children. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 180155.

Martorella, P.H. (1979). Cognition Research: Some Implications for the Design of Social Studies Instructional Materials. [A.A.U. CD-ROM]. Abstract from: ERIC:ED 211394.

McKim, M.K.(1979). Natural Determinants of Change in cognitive Tempo. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 196550.

Messer, S. (1970 a). Reflection - Impulsivity: Stability and School Failure. Journal of Educational Psychology, 61(6), 487-490.

Messer, S. (1970b). The Effects of Anxiety Over Intellectual Performance on Reflection-Impulsivity in Children. Child Development, 41(3), 723-735.

Mitchell, C. & Ault, R.L. (1977). The Relationship of Some Problem Solving Variables to Cognitive Tempo. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 140958.

Mitchell, J.V., Jr. (Ed.) (1985). The Ninth Mental Measurement Yearbook, Vol.1, 908-909. Lincoln: The University of Nebraska Press.

Okun, M.A. et al. (1979). Adult Age Differences in Cognitive Tempo. [A.A.U. CD- ROM]. Abstract from: ERIC:ED 174632.

Ozawa, J.P. & Michael, w.b. (1983). the concurrent Validity of a Behavioral Rating Scale for Assessing Attention Deficit Disorder (DSM III) in Learning Disabled Children. Educational and psychological Measurement 43(2), 623-632.

Quay, L.C.; Popkin, M.; Weld, G.& McLeskey, J. (1978). Responses of Normal and Learning Disabled Children as a Function of the Stop-Watch in the Matching Familiar Figures Testing Situation. Journal of Experimental Child Psychology, 26(2), 383-388.

Reid, D.K. (1975). The Effects of Cognitive Tempo and the Presence of a Memory Aid on Conjunctive Concept Attainment in Educable Mentally Retarded Boys. [A.A.U. CD-ROM]. Abstract from: ERIC:ED 162483.

Salkind et al. (1978). Cognitive Tempo in American, Japanese, and Israeli Children. Child Development, 49(4), 1024-1027. [A.A.U. CD-ROM]. Abstract from: ERIC: EJ 196652.

Salkind, N.J. & Kojima, H. (1977). Cognitive Tempo in Japanese and American Children. [A.A.U. CD-ROM]. Abstract from: ERIC:ED 1361916.

Saracho, O.N. & Dayton, C.M. (1980). Relationships of Teachers' Cognitive Styles to Pupils' Academic Achievement Gains. Journal of Educational Psychology, 72(4), 544-549.

Schwab, L. (1973). Modification of Impulsive Cognitive Tempo in Fourth Grade Children and Its Effects upon Their Performance of a Social Studies Task. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 83090.

Siegelman, E. (1969). Reflective and Impulsive Observing Behavior. Child Development, 40(4), 1213-1222.

Stenberg, L. et al. (1982). Cognitive Tempo and Cognitive Level Relationships Among Mentally Retarded Children. [A.A.U. CD-ROM]. Abstract from: ERIC: EJ 273742.

Sola, J. & Phye, g.D. (1975). Task Structure and, cognitive Tempo Influence on Organizational Memory Children. [A.A.U. CD-ROM]. Abstract from: ERIC: ED106722.

ctor, J.B.; Halverson, C.F., Jr.; & Montague, R.B. (1985). Relations Between Reflection-Impulsivity and Behavioral Impulsivity in Preschool Children. Developmental Psychology 21(1), 141-148.

Walker, N.W. (1981). Modifying Impulsive Responding to Four WISC-R Subtests, [A.A.U.

CD-ROM]. Journal of School Psychology, 19(4), 335-339. Abstract from: ERIC: EJ 256121.

Walker, N.W. (1982). Comparison of Cognitive Tempo and Time Estimation by Young Boys, [A.A.U. CD-ROM]. Perceptual and Motor Skills, 54(3), 715-722. Abstract from: ERIC: EJ 272025.

Walker, N.W. (1985). Interactional Effects of Socio-economic Status and Cognitive Tempo on WISC-R Performance. [A.A.U. CD-ROM]. Measurement and Evaluation in Counseling and Development, 18(2), 58-63. Abstract from: ERIC: EJ 320824.

Weiner, A.S. & Adams, W.V. (1974). The Effects of Failure and Frustration on Reflective and Impulsive Children. Journal of Experimental Child Psychology, 17(2), 353- 359.

Wyatt, D.M. & Fulton, A. (1987). Effects of Cognitive Tempo on Preschool Children's Use of the Computer. [A.A.U. CD-ROM]. Abstract from: ERIC: ED 280618.

Yando, R.M. & Kagan, J. (1968). The Effects of Teacher Tempo on the Child. Child Development, 39(1), 27-34.

Yap, J.N.K & Peters, R.d. (1985). An Evaluation of Two Hypotheses concerning the dynamics of Cognitive Impulsivity: Anxiety - Over - Errors or Anxiety - Over -

competence? Developmental Psychology, 21(6), 1055-1064.

Zelniker, T.; Jeffrey, W.E.; Ault, R. & Parsons, J. (1972). Analysis and Modification of Search Strategies of Impulsive and Reflective Children on the Matching Familiar Figures Test. Child Development, 43, 321-335.