

JOURNAL OF HUMAN BEHAVIOUR & DEVELOPMENT ISSUES

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- COMMUNITY PSYCHOSOCIAL RESEARCH (COMPRES): A NEW RESEARCH FOCUS AREA FOR COMMUNITY RESEARCH AT THE NORTH-WEST UNIVERSITY IN SOUTH AFRICA
- THE ILLNESS PERCEPTION AND MEANING-MAKING OF PEOPLE LIVING WITH HIV/AIDS
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- "THINK AND GROW RICH" - AUTHOR: NAPOLEON HILL



JOURNAL OF HUMAN BEHAVIOUR AND DEVELOPMENT ISSUES

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August 2015

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Self-Regulation and Creativity in Elementary School Children: Twin Study Analysis

B. S. Sandhu*

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Self-Regulation can be best referred to the self's capacity to alter its behaviours (Baumeister & Vohs, 2007). It increases the degree to which human behaviour is flexible and able to adapt. Self-regulation has been found to be associated with success or failure in many different domains such as education, health, personal growth etc. Insufficient self-regulation has been found leading to underachievement in school. In the academic context creativity is another important variable which provides students with choices, ability to accept different ideas, boosts their self-confidence, and helps to build upon the students' strengths and interests whereby enhancing their academic achievement. It is a pulsating force beneath the academic and artistic endeavours of young children and adolescents. Little research has been done into understanding if Self-Regulatory capacities and creativity are inherent or acquired. The classical twin study method was used in the present study to assess the extent of plasticity of self-regulation and creativity amongst elementary school children. The sample comprised of 120 (60 twin pairs) of elementary school children with 30 identical twin pairs (MZ) and 30 fraternal twin pairs (DZ) (age ranging 9-12 years) reared together and each pair studying in the same school. Results point towards the significant contribution of the genotype in Self-Regulation and a conjoint role of nature and nurture in creativity indices.

Keywords: Self-Regulation; Creativity; Heritability estimate; Elementary school children

Self-regulation can be termed as a broad concept encompassing a number of interdependent aspects including, affective capacities i.e. moods, feelings and emotions and cognitive capacities i.e. beliefs, perceptions and knowledge. Self-Regulation is conceptualized as a generic umbrella including the set of processes and behaviours that support the pursuit of personal goals within a changing external environment. Barkley (2001) defines self-regulation as altering of the responses by acting on the self. It increases the flexibility and adaptability of an individual's behaviour by enabling him to adjust his actions to a remarkably broad range of social and situational settings (Baumeister, Heatherton, & Tice, 1994). Bronfenbrenner and Ceci (1994) in the bio ecological model explained that an individual remains central to development over time.

The nature vs. nurture debate which has its relevance in dynamics of every psychological phenomenon seems to have serious implications for self-regulation as well. Proponents of behaviourist and gestalt traditions posit that personality development occurs as a result of interactions with

the environment. Contrarily trait and psychodynamic theorists look within the individual to seek reasons behind growth of personality. In the same regard an individual's ability to self-regulate behaviours and emotions may be identified and explored by having a critical understanding of innate and biological characteristics along with the environmental contexts in which he/she is dwelling. Self-regulation strategies displayed by an individual reflect his/her temperamental or inborn characteristics (Eisenberg et al., 2003; Kochanska et al., 1997; Zahn-Waxler et al., 1996; Rothbart, Derryberry & Posner, 1994). The ability to inhibit an unfavourable response by a stabilized "effortful control" on the behaviour has been documented from toddlerhood to early school age. Dynamics of Self-Regulatory processes is a complex phenomenon especially in case of twins. Unlike the first-born child, after birth the infant twins face two opposing maternal images, a mother who through her containment of the twin, can aid development but the same mother, who in so doing also interferes in the twinship (Burlingham, 1952). Beaver et al. (2009) analysed contribution of genetic and environmental influences on levels of self-control and delinquent peer affiliation. Results were obtained from a longitudinal sample of adolescence twins. The data revealed that both self-control and contact with drug using friends were influenced by genetic factors and the non-shared environmental,

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whereas the shared environment exhibited relatively small and inconsistent effects.

On a similar pattern the origins of creativity have been explored from both the genotype and phenotype perspectives. Dreyer and Wells (1966) supports that nurture plays a vital role and strongly advocate that it is the environment in which a child grows that really inculcates creativity in them. He believes that any child nurtured in a creative environment would begin to exhibit creative traits in their life. J. B. Watson's (1925) statement is a classic example of this school of thought.

"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors." – John B. Watson (1974).

On the other hand recent researches have begun to explore the contributory role of genetics in creativity. Reuter, Roth, Holve, and Hennig (2006) described what they called the first candidate gene for creativity. This study replicated and extended their work for a more careful analysis of five candidate genes: Dopamine Transporter (DAT), Catechol-O-Methyltransferase (COMT), Dopamine Receptor D4 (DRD4), D2 Dopamine Receptor (DRD2), and Tryptophane Hydroxylase (TPH1). Study also revealed that fluency, by itself, was not an adequate measure of creativity, and that originality had a negligible relationship with the genes under investigation. In a study of high mathematical creativity (Haylock, 1984) in pair of identical twins aged 11 to 12 years, twin boys were found to have almost identical profiles in a series of assessment of some significant personality and attitude characteristics.

Amidst these equivocal findings supporting both nature and nurture as playing significant contribution in shaping self-regulation as well as creativity particularly in children, the present study aims to unravel the distinct contributions that exist in this regard. The idea of using twins to study factors affecting human behavioural variation was first discovered by Sir Francis Galton in 1875. The classical twin study method was used in the present study to assess the extent of plasticity of self-regulation and creativity amongst elementary school children.

Hypotheses

1. Intra pair correlations of indices of Self-regulation (Identified regulation and Intrinsic Motivation) would be higher in MZ as compared to DZ twins studying in elementary school.
2. Intra pair correlations of indices of Self-regulation (Extrinsic and introjected regulation) would be higher in DZ as compared to MZ twins studying in elementary school.
3. Intra pair correlations of Creativity indices (i.e. Fluency, Flexibility and Originality) would be higher in MZ as compared to DZ twins studying in elementary school.
4. Significant proportion of variance in Self-Regulation and Creativity scores would be attributable to genetic variance amongst elementary school children.

Method

Participants

The sample comprised of 120 (60 twin pairs) elementary school children studying in various public schools of Patiala and Chandigarh. There were 30 identical twin pairs (MZ) and 30 fraternal twin pairs (DZ) (age ranging 9 - 12 yrs.) reared together and each pair studying in the same school. Initially the school authorities were requested to provide information of twin pairs on roll. Details on monozygosity and dizygosity were later procured from the school records. Parental consent was obtained keeping in mind the ethical issues involved in psychological testing.

Procedure

Administration of the test was done in a group setting. Each group comprised of 10 subjects (i.e. 5 twin pairs). Rapport was established with the subjects before administration of the test to ascertain their involvement. Standard verbal instructions were given before each test since the reading ability of elementary school children is not proficient. Testing was done over a period of three different sessions. The first session was used for rapport building with the twin pairs. Both identical twin pairs and fraternal pairs were administered the Academic Self-Regulation scale by Ryan and Cornell (1989). On the next day, the Torrance test of creativity was administered to the twin pairs. Finally the psychological testing concluded with a session of games and snacking treat of sweets and chocolates. A Follow up session was done with

parents and children with the purpose of providing information about the results to the parents.

Measures

Torrance Tests of Creative Thinking (1962): Torrance test of Creative Thinking (Figural forms, Torrance. E. Paul, 1974): Torrance's method of assessment of creative potential especially figural forms emphasize the ability to generate many new ideas (Fluency) that are unusual (Originality) and represent a variety of categories (Flexibility) as well as ability to embellish the ideas (Elaborations). Test battery comprised of 3 figural activities:-

- | | |
|--------------------------|---------------|
| i. Figural tasks | Time allotted |
| ii. Picture construction | 10 minutes |
| iii. Picture Completion | 10 minutes |
| iv. Lines | 10 minutes |

In the Picture construction task something clever and unusual is expected to be drawn using an egg-shaped piece of paper. In the Picture completion task abstract lines are to be completed as objects. In the Parallel lines task the parallel lines are to be completed as objects.

Academic Self-Regulation Questionnaire (ASRQ, Ryan & Connell, 1989): The scale assesses children's styles of regulating their behaviour in the academic domain on a continuum from external control to autonomous self-regulation. The 26 items comprising the questionnaire present reasons why children engage in school-related behaviours such as doing homework, doing classwork, and answering difficult questions in class. Following each reason, children rate, on 4-point Likert-type scales, how true the reason is for their own behaviour. Items were associated with four subscales representing less to more autonomy in children's self-regulation: external (to avoid negative consequences or because of externally imposed rules); introjected (to gain adult approval or avoid negative affects); identified (to achieve a self-valued goal); and intrinsic (for inherent enjoyment of the activity). Alpha reliabilities for these subscales range from .75 to .88.

Results

The main objective of the present investigation was to study associations between Creativity and Self-Regulation in MZ and DZ twins and calculating the heritability estimates for each variable.

Intrapair coefficient of correlations for External Self-Regulation had a significant positive association of $r = 0.34$, $p < .01$ level in DZ twin pair. On the other hand value for intrapair coefficient of correlations in the MZ twin pair was $r = 0.88$, $p < .01$ level. This reveals that whatever may be the source, children with the same genotype have almost similar levels of extrinsic forms of Self-Regulation. A similar picture emerges for Introjected Self-Regulation with $r = 0.75$, $p < .01$ highly indicative of nearly identical levels of Introjected forms of Self-control or the MZ twin pair. Though intrapair coefficient of correlations for Introjected Self-Regulation had a positive and a significant association of $r = 0.39$, $p < .01$ level for DZ twin pair yet it was relatively smaller as compared to the intrapair coefficient of correlation for the MZ twins. The MZ twin pairs had very high intrapair correlation value again for Identified Self-Regulation with $r = 0.84$, $p < .01$ consistently depicting the strong similarity in level of Identified Self-Regulation between the monozygotic twin dyad. For the DZ twins Identified Self-Regulation had an intrapair coefficient of correlations, $r = 0.30$, $p < .05$ level. Intrinsic motivation had the highest intrapair association with $r = 0.66$, $p < .01$ for the DZ dyad almost comparable to that of the MZ pair i.e., 0.68 , $p < .01$. The major role of genotype in influencing all forms of Self-Regulation becomes clearly evident from high correlations in the levels intrapair coefficient of correlations of MZ pairs relative to the DZ pairs. Zahn-Waxler et al. (1996) studied behaviour problems in 5 year old MZ and DZ twins, genetic and environmental influence, and patterns of regulation and internalization of control in 5 year olds. Correlations between observed patterns of regulation at ages 3, 4 and 5 years and behaviour problems at age 5 years were often significant for MZ twins in comparison to DZ twins. Wade, Milner and Kronl (1981) studied evidence for a physiological regulation of food selection and nutrient intake in twins. The genetic effect on nutrient intake was assessed in 13 MZ and 10 DZ pairs of healthy female adult Caucasian twins. Calculations based on the concentrations of energy as percentage of calories from protein, fat, carbohydrate, and alcohol, were calculated from 3-day food records. Nutritive intake of monozygotic twins was significantly similar relative to DZ twins for the protein concentration, the carbohydrate concentration, and the absolute intake of carbohydrate per day. The above cited provides interesting insights into how even regulation of diet amongst MZ twins has greater levels of similarity.

Thus in free-living humans even primitive physiological mechanisms influencing food selection are operative and that these mechanisms are highly subject to genetic influence. Beaver et al., (2009) studied genetic and environmental influences on levels of Self-Control and delinquent peer affiliation. Results were obtained from a longitudinal sample of adolescence twins. The data revealed that both self-control and contact with drug using friends were influenced by genetic factors and the non-shared environment, whereas the shared environment exhibited relatively small and inconsistent effects.

Amongst the fraternal (DZ) twin pairs intrapair coefficient of correlations on indices of Creativity ranged from ($r = 0.06$ to 0.53). For the MZ twin pairs intrapair coefficient of correlations on indices of Creativity ranged from ($r = 0.09$ to $r = 0.69$). Originality sub-dimension of Creativity had a positive intrapair coefficient of correlations of $r = 0.34$, $p < .05$ level in the DZ twin pair. For the MZ twin pair, inter pair correlation for Originality component of Creativity was $r = 0.09$ which was considerably lower than the DZ twins correlation. Similarly Flexibility component of Creativity had a strong correlation for the DZ twin pair ($r = 0.53$, $p < .01$) in comparison to the within MZ twin pair ($r = 0.33$, $p < .05$ level). These results indicated that MZ twin pairs differed in their exploratory strategies and creative expressions thus leading to reduced intrapair coefficient of correlations on Originality and Flexibility.

A comparative analysis reveals that for DZ twin pairs no significant intrapair coefficient of correlations emerged for Fluency ($r = 0.06$) whereas for the MZ twin pairs Fluency association was significantly high ($r = 0.43$, $p < .05$). Intrapair correlations of Elaboration for DZ twins had an r value of 0.18 which is a weak association. On the other hand Elaboration intrapair coefficient of correlations for the MZ twin pairs were highest at $r = 0.68$, $p < .01$ level, very clearly demarcating the role of genotype in influencing the expansion of ideas and fluency of responses amongst elementary school children.

Thus for the third hypothesis it may be concluded that both nature and nurture are differentially effecting the sub components of Creativity. These results corroborate the findings of Reznikoff's (1973) study that had explored genetic influence in creative abilities. The pool of subjects for this study consisted

of 117 pairs of twins, 13-19 years of age. A battery of ten creativity tests, including five developed by Guilford, and one measure of verbal intelligence were administered to each subject. The majority of intraclass correlations for both the monozygotic and dizygotic twins on the 11 measures attained statistical significance, with the correlations tending to be somewhat higher in the identical twin groups. When the intrapair variances of the identical and fraternal twins were contrasted directly on the various tests, there were few statistically significant results. Inter-correlations between the 11 tests compared two at a time revealed higher correlations in the monozygotic group, indicated a somewhat more consistent performance from test to test. These results impel us to further explore the role of genotypical variations in Self-Regulation and Creativity by calculating the Heritability Coefficients for each of the indices.

The third hypothesis stating that "Significant proportion of variance in Creativity, Self-Regulation scores would be attributable to genetic variance amongst elementary school children" was verified after calculation of Heritability Estimates using the Falconer's formula. Within the sub components of creativity, Fluency had Heritability Estimate of 0.75 indicating that 75% of variance in scores of elementary school children were under the influence of genetic variations. The Heritability Estimate of 0.40 showed that 40% of variance in Flexibility sub component of Creativity was attributable to the genotype. Originality obtained a Heritability Estimate of 0.50 which denotes that the genotypical variation was responsible for creating 50% of the variation in scores of elementary school children in novelty of responses. Extremely high Heritability Estimates bordering around 1 are suggestive of the fact that 100% variance in scores for Elaboration, Extrinsic Self-Regulation (i.e. Heritability Estimates of 1.02 , 1.09 and 1.09 respectively) had been caused by genetic variance. Retrospectively considering, these estimates are spuriously high and may be a result of error of measurement obtained from a smaller sample of participants. 71% variance in scores for Introjected Self-Regulation could be interpreted to be emerging from genotype variations since the computed Heritability Estimates stood at 0.71 . Intrinsic Self-Regulation obtained a Heritability Estimate of 0.06 denoting that a mere .06% variance was being governed by genotype variance. These Heritability Estimates show a varied picture from the correlations obtained by the MZ and DZ twins

on Self-Regulation. Again a small sample could be the reason behind almost negligible Heritability estimate values for Self-Regulation.

On a similar pattern Mosing et al. (2009) studied genetic and environmental influences on optimism and its relationship to mental and Self-Regulation. Genetic factors explained 36%, 34% and 46% of the variation in optimism, mental and Self-Regulation, due to non-shared environmental influences. Yamagata et al. (2005) studied genetic and environmental aetiology of effortful control. The results indicated that effortful control had substantial genetic basis and had a genetically coherent structure. Keller et al. (1992) studied work values in 23 MZ and 20 DZ twins reared - apart to test the hypothesis that genetic factors are associated with work values. Univariate and Multivariate analysis were performed. Results indicated an average 40% of the variance was related to genetic factors and 60 %of the variance to environmental factors.

Concluding Remarks

Since Self-Regulation is a fundamental attribute to sense of positivity and wellbeing, results of the study clearly point at a strong contribution of environmental influences in shaping this capacity. Children picked early in schooling can be trained to enhance their self-regulatory capacities which would have far reaching effects on their personal growth.

As we know creativity is an asset in the classroom since it provides the students with the possibility of exploring different ideas, boosting self-confidence and initiating novelty even in mundane aspects of classroom teaching. Academic achievement can thus be promoted through external sources since the present study also sheds light on the plasticity of creativity.

Avenues for further research point towards cross sectional as well as longitudinal assessment of these two variables to ascertain how far the role of the genotype exerts control over the phenotype.

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Table No.1:- Intra pair correlation of indices of Self-Regulation for MZ and DZ twins

Self-Regulation	Intra Pair Correlation	
	MZ	DZ
External Regulation	0.88**	0.34*
Introjected Regulation	0.75**	0.39**
Identified Regulation	0.84**	0.30*
Intrinsic Motivation	0.68**	0.66**

Table No.2:- Intra pair correlation of Creativity indices (Fluency, Flexibility and Originality and Elaboration) for MZ and DZ twins.

Creativity Indices	Intra Pair Correlation	
	MZ	DZ
Fluency	0.43*	0.06
Flexibility	0.33*	0.53**
Originality	0.09	0.34*
Elaboration	0.69**	0.18

Table No.3:- Showing Heritability Coefficients (using Falconer's formula) depicting Heritability Estimates of Creativity and Self-Regulation.

	Fluency	Flexibility	Originality	Elaboration	External Regulation	Introjected Regulation	Identified Regulation	Intrinsic Motivation
Fluency	0.75							
Flexibility		0.40						
Originality			0.50					
Elaboration				1.00				
External Regulation					1.00			
Introjected Regulation						0.71		
Identified Regulation							1.00	
Intrinsic Motivation								0.06

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