International Research Journal of Human Resources and Social Sciences
Impact Factor- 3.866
Vol. 3, Issue 4, April 2016 ISSN(O): (2349-4085) ISSN(P): (2394-4218)
© Associated Asia Research Foundation (AARF)
Website: www.aarf.asia Email : editor@aarf.asia , editoraarf@gmail.com

EFFECT OF WILLIAMS' COGNITIVE – AFFECTIVE INTERACTION MODEL ON CREATIVITY IN MATHEMATICS

Dr. H.S. Brar (Principal, GHG Khalsa College of Education, Gurusar- Sadhar)

Rachhpal Singh (Asstt. Prof., GHG Khalsa College of Education, Gurusar- Sadhar)

ABSTRACT

This study was focused to see the effect of Williams' Cognitive – Affective Interaction model on creativity in mathematics. This was a true experimental study. The research was carried out in schools in Ludhiana district on a sample of 160 students. Two equal groups were formed on the basis of intelligence. Effect of Williams Model and Traditional Method of Teaching on Creativity was assessed by S^2MCT tool developed by Sharma and Sansanwal (2012). The result revealed that Williams' model proved to be better for enriching creativity over traditional method of teaching mathematics. Students of both low and high intelligence do not differ significantly in their scores of creativity in Mathematics and there is no significant interaction between teaching strategies and intelligence on the creativity in Mathematics.

Keywords: Williams' Model, Traditional Method, Creativity in Mathematics.

Introduction

Innovations are directly or indirectly related to human originality and creative potentialities. As such, creative potentialities of the individuals need to be developed among all the individuals through appropriate means for the greater benefit to the society. Education, as we know, is the most effective means for development of the innate abilities of the individuals, appropriate educational programmes needs to be evolved in the form of teaching strategies and techniques for the development of creative potential among the learners. Present day classroom transaction systems provide little opportunity for creative pursuit. Many models of teaching have been

developed to enhance creativity among the learners like Inductive Thinking model (Taba, 1966), Synectics Model (Gordon, 1961), Kaplan Model (1993), Maker's Model (1993), and Williams (1993). Among all of the above the Williams' Frank E. model of teaching is one such approach specifically meant for enhancing creativity among learners. Making our classrooms more interactive, interesting and teaching through creative programme enables the students to feel that mathematics is very practical, easy to learn and close to real life.

Williams had developed a cognitive-affective teaching model. William's argument was based on the principle "Thinking processes cannot really operate without feeling processes. Nearly all cognitive Behaviour has an affective component" For effective human development, the combination of both cognitive and affective domains is needed. The pupils' need for knowledge and information is closely related to his personality dispositions and his internal set of values. Williams discussed the theoretical basis and educational uses of 4 models of cognitive-affective behavior: (a) Piaget's stage theory of intellectual development, (b) Bloom's taxonomy of the cognitive domain, (c) Krathwohl's taxonomy of the affective domain, and (d) Guilford's structure of intellect model. A new model, an outgrowth is presented which is designed for use by the teacher in encouraging creativity in young children. Dimension 1 of the model lists subject matter, Dimension 2 lists 18 teaching strategies, and Dimension 3 lists 4 cognitive and 4 affective pupil behaviors. Use of the model in curriculum planning, teacher instruction, classification and analysis of instructional media, and in educational programs for the gifted are described. It is concluded that this model may narrow the distance between what is known about the cognitive-affective processes and how this is utilized in educational practices. This model is based upon studies of the creative person and process. This model has three dimensions:

Dimension 1 consists of subjects that comprise the school curriculum, Dimension 2 includes teacher behaviour, these comprise 18 strategies to be used by the teacher to develop student thinking and creativity and Dimension 3 consists of eight student processes that have been shown empirically to be involved in creative thinking. The model has been devised to give students the opportunity for creative thinking (characterized by fluency, flexibility, originality, and elaboration).

Development of creativity in mathematics is priority area among researchers and mathematicians. Mathematical creativity is problem solving type fact-finding activity (Sharma, 1972). The creative potential contributes to the improvement of mathematical knowledge. Mathematical creativity ensures the growth of mathematics as a whole. Mathematical creativity

is the ability to choose between useful and useless combinations. It is also multifaceted construct involving both divergent and convergent thinking, problem finding and problem solving, self-expression, intrinsic motivation, a questioning attitude and self-confidence (Runco, 1993).. Mathematical creativity is ability to solve problems and to develop thinking in structures of mathematics (Ervynck, 1991), to observe patterns (Laylock, 1970), to abstract and generalize mathematical content (Krutetskii, 1976), to understand which patterns are acceptable (Birkhoff, 1969) and to make connections between unrelated ideas (Haylock, 1987).

Creative teaching strategies encourage expressions of inquisitiveness, risk-taking (educational), achievement, creative abilities, imagination, and intricacy that research has recognized as significant factors in demonstration of creativity, Williams (1986). This model (a) stimulates creativity and task commitment in students selected for the program, (b) facilitates the development of more diverse and sophisticated students creative product, Renzulli and Reis (1994). Teaching by this model encourage fluent and elaborative thinking, curiosity, risk taking, complexity and imagination of students, Shah (2011).

Objectives

1. To investigate the significant difference in creativity in Mathematics of the groups taught through Williams' model and conventional teaching.
2. To investigate the significant difference in creativity in Mathematics of the groups having high and low Intelligence.
3. To investigate the significant interaction between teaching strategies and intelligence on creativity in Mathematics.

Hypotheses

1. There will be no significant difference in the creativity in Mathematics of the groups taught through traditional method of teaching and through William's model.
2. There will be no significant difference in the creativity in Mathematics of the groups having high and low Intelligence.
3. There will be no significant interaction between teaching strategies and intelligence on the creativity in Mathematics.

Sample of the study

A sample comprising 160 students was raised for the study. The sample included male as well as female students studying in the class IX.

Design of the Study

To study the effectiveness of Williams' cognitive-affective interaction model of teaching on the Achievement and creativity in mathematics, "pre-test post-test parallel group" design was be used.

Procedure

The investigator developed a test of achievement in Mathematics for the 9^{th} class students. In the first step, Intelligence test was employed on 160 students to classify the sample into two matched groups (Group A and Group B). In pre-test phase both the groups were given Mathematical creativity test. The obtained scores were tabulated. One group was assigned to the treatment. This was termed as experimental group and the other was termed as control group. The experimental group was taught by William's Cognitive-affective Interaction Model strategy (with modules prepared by researcher) for a period of 50 sessions at the rate of 30 minute per day. On the other hand control group was taught the same concepts with the help of conventional method for the same period. After completion of the treatment the Mathematical creativity test was again administered to both the groups as post-test. Analysis was done as per the objectives of the study.

Tools used

The following tools were used to collect the data.

1. Teaching modules based on Williams' Model and Conventional teaching for different Mathematical concepts for Class IX developed by the investigator.
2. Mathematical Creativity Test by Sharma and Sansanwal (2012).
3. Verbal Intelligence Test (VIT) by Ojha and Roychoudhary (2001) revised version.

Analysis and Interpretation of data

Table 1: t-test Group Statistics

	Groups	N	Mean	Standard Deviation	t-ratio
Gain Scores of Creativity in Mathematics	Controlled Group	80	10.02	10.97	6.86
	Experimental Group	80	24.16	14.81	
	Low Intelligence	44	21.39	17.258	1.47
	High Intelligence	44	16.59	12.926	

Table 1 reveals that values of mean for controlled group and experimental group are 10.02 and 24.16 respectively. The value of t-ratio is 6.86 which is significant. Therefore, the hypothesis ' There will be no significant difference in creativity in Mathematics of the groups taught through Williams' Model and traditional Method' is rejected at both i.e. 0.05 and 0.01 levels of significance, which means that the Creativity in Mathematics of the groups taught through Williams' Model and traditional Method are significantly different. The creativity in Mathematics of experimental group (Mean = 24.16) is thus significantly higher as compared to controlled group (Mean = 10.02).

Mean for Low intelligence and high intelligence are 21.39 and 16.59 respectively. The t-ratio value is 1.47 .Therefore the hypothesis, 'There will be no significant difference in creativity in Mathematics of the groups having low and high Intelligence' is accepted at both 0.05 and 0.01 level of significance.

Table 2

Tests of Between-Subjects Effect

Dependent Variable: Scores of Creativity in Math

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7369.48[a]	3	2456.49	15.71	0.00
Intercept	31730.01	1	31730.01	203.03	0.00
Intelligence	505.92	1	505.92	3.23	0.07
Group	6650.28	1	6650.28	42.55	0.00
Intelligence * Group	213.28	1	213.28	1.36	0.24
Error	13127.50	84	156.28		
Total	52227.00	88			
Corrected Total	20496.98	87			

Table 2 reveals that the F-statistic corresponding to intelligence is 3.23, which is significant at p = 0.07. The F-statistic corresponding to group (method of teaching) is 42.55, which is significant at p<0.01. The interaction between Intelligence and group is non-significant as p = 0.24 with F statistic 1.36. Therefore the hypothesis, 'There will be no significant interaction between teaching strategies and intelligence on the creativity in Mathematics', is partially accepted.

Implications of the Findings of the study:

- Creativity in mathematics of group taught through Williams' model is significantly more as compared to group taught through traditional method. Thus Williams' model proved to be better for enriching creativity over traditional method of teaching mathematics. Therefore Williams's method should be applied in mathematics classrooms to enrich creativity in mathematics among students studying in Government schools of Punjab.
- Students having low and high intelligence does not significantly differ in their creativity in Mathematics. Hence, teaching through Williams's model is equally effective for low

and high group students on the basis of intelligence. So, all kind of students be they gifted, average and below average in intelligence can be taught through Williams' model to enhance their creativity.

- There is no significant interaction between teaching strategies and intelligence on the creativity in Mathematics. Creativity being the highest order in taxonomy of learning objectives should be inculcated among all the students irrespective of intelligence, gender or locale.

References

Asha, C. B. (1980). Creativity and academic achievement among secondary school children. *Asian Journal of Psychology and Education*, 6(3),1-4.

Baskara, S. (1981). *A Study of the effectiveness of verbal creativity instructional materials at school stage*. Unpublished M.Ed. dissertation Maharaja Sayajiro University of Baroda, Vadodra.

Best, J.W. (1983). *Research in Education* (4th ed.). New Delhi: Prentice Hall of India Pvt. Ltd.

Birkhoff, G. D. (1969). Mathematics and Psychology. *Society for Industrial and Applied Mathematics Review*, 11(17), 429-469. Retrieved on March 30, 2014 from http://www.siam.org/journals/sirev.php

Ervynck, G. (1991). Mathematical Creativity. *Journal of Advanced mathematical thinking***.** Retrieved on March 25, 2014 from http://www.siam.org/journals/mathcre.php

Haylock, D.W. (1987). Mathematical creativity in school children. *The Journal of Creative Behavior*, 21(1), 48-59.

Joyce, B. & Weil, M. (2003). *Models of Teaching* (5th ed.). New Delhi: Prentice Hall of India Private Limited.

Krutetskii, V. A. (1976). *The Psychology of Mathematical Abilities in School Children.* Chicago: University of Chicago Press.

Laycock, M. (1970). Creative Mathematics at Nueva. *Arithmetic Teacher*, 17(4), 325–328. Retrieved from http://www.nctm.org/publications/content.aspx?id=8590

Mann, E. L. (2005). *A study of mathematical creativity and school mathematics indicators of mathematical creativity in middle school students*. Unpublished Ph.D. thesis, University of Connecticut. Retrieved on March 29, 2014 from http://www.gifted.uconn.edu/ siegle/dissertations/Eric%20Mann.pdf

Mann, E. L. (2006). Creativity: The essence of Mathematics. *Journal for the Education of the Gifted*, 30 (2), 236-262.

NSW Department of Education and Training (2004). *Policy and Implementation strategies for the education of gifted and talented students.* Sydney: New South Wales Department of Education and Training, Curriculum K-12 Directorate.

Ojha, R.K., & Roychoudhary, K. (2001). Verbal Intelligence Test. Agra: National Psychological Corporation.

Renzulli, J.S. (1993). *Systems and Models for developing programs for the gifted and talented*. Sydney: Hawker Brownlow Education.

Renzulli, J. S., & Reis, S. M. (1994). research on school wide enrichment triad model. *Gifted Child Quarterly*, 38(3), 7–20. Retrieved on March 11, 2014 from www.casenex.com/casenex/cecReadings/revisitingTheSchoolwide.pdf

Shah, G. C. (2011). *A study of effectiveness of creative teaching programme on the achievement of students of standard VII in mathematics.* Unpublished Ph.D. thesis, Gujarat University, Ahmedabad. Retrieved on March 29, 2014 from http://shodhganga.inflibnet.ac.in/handle/10603/4345

Sharma, Y. & Sansanwal, S. S (2012). *Mathematical creativity test.* Kapurthala: Axiomatic Educational Services, 455, Urban Estate.

Williams, F. E. (1969). Models for encouraging creativity in the classroom by integrating cognitive-affective behaviors. *Educational Technology*, 9(12), 7-13. Retrieved on March 21, 2014 from http://psycnet.apa.org/psycinfo/1971-23874-001.

Williams, F.E. (1970). *Classroom ideas for encouraging thinking and feeling (2nd ed.).* New York: D.O.K Publishers. Retrieved on March 11, 2014 from http://www.sengifted.org /archives/articles/a-case-for-affective-education-addressing-the-social-and-emotionalneeds -of-gifted-students-in-the-classroom#sthash.wWAuBOfp.dpuf

Williams, F. E (1993). *The Cognitive-Affective Interaction Model for enriching gifted programs*. In Renzulli, J.S. (Edu.), *Systems and Models for developing programs for gifted and talented*, 461-484. Sydney: Hawker Brownlow Education