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INFLUENCE OF COGNITIVE STYLE, ACHIEVEMENT IN SCIENCE AND GENDER ON SCIENTIFIC CREATIVITY OF SECONDARY SCHOOL STUDENTS

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Abstract

The aim of the present research was to investigate the relationship of Cognitive style, Achievement in science, Gender and their interaction on scientific creativity of secondary school students. Survey method was used. The sample comprised of 158 students of Classes IX and X studying in schools affiliated to Central Board of Secondary Education in SBS Nagar district of Punjab. Standardized tools used to access the variables were Majumdar Scientific Creativity Test and Group Embedded Figures Test by Witkin, Oltman, Ruskin and Karp. Marks of students from school records were taken as a measure of their Achievement in science. The data was analyzed using ANOVA. Scientific creativity was found to be significantly influenced by Achievement in science and Gender. Scientific Creativity was found to be independent of Cognitive style. Scientific Creativity of secondary school students was found to be independent of interaction between Cognitive Style and Achievement in Science and between Cognitive style and Gender..

Keywords: *Cognitive style, Achievement in science, Gender, Scientific creativity, Secondary school students*

Introduction: Knowledge of science and creative vision of have become two important quality parameters in the contemporary society- which is highly technical, as well as complex. In this context, fostering creativity in science education is also becoming more and more important. As a consequence, investigation of creativity in science education, to be called precisely as scientific

creativity is also receiving increasing attention of science educators. Creativity in science education thus has emerged as an independent field of research. Howe (2004) pointed out that scientific creativity is more than having fun and coming up with wacky ideas or doing your own thing. Heller (2007) defined the hypothetical construct scientific ability as scientific thinking potential or as a special talent for excellence in sciences. Similar to this definition, "scientific creativity" or "technical creativity" can be conceptualized as individual and social capacities for solving complex scientific and technical problems in an innovative and productive way.

Scientific creativity is the ability to find and solve new problems and the ability to formulate hypotheses; it usually involves some addition to our prior knowledge, whereas artistic creativity may give some new representation of life or feelings (Liang, 2002). According to Torrance, central features of creativity are fluency, flexibility and originality (Hu and Adey, 2002). Mukhopadhayay (2011) considered fluency, flexibility, originality as important creteria of scientific creativity.

Witkin and his associates (1967) described this dimension of cognitive style as a continuum ranging from an analytic to a global approach to perceptual and cognitive activities. Field independent people are characterized by their ability to distinguish and coordinate items extracted from a complex stimulus context that may be confusing for others. Field-dependent people, however, tend to preserve the holistic nature of the stimulus and conform to the prevailing field. Cognitive style has important implications for learning and instruction. Field dependence/independence is the most important cognitive style dimension because it can be used to explain and categorize the various learners' behaviour choices. It is a characteristic of cognitive processing which is particular to a certain individual or class of individuals. Cognitive style measures do not indicate the content of the information but simply how the brain perceives and processes the information.

In the Standards for test construction (APA, 1999) achievement is viewed basically as the competence a person has in a area of content. This competence is the result of many intellectual and nonintellectual variables. In addition, Tang (1986) suggested that broad knowledge may enhance scientific creativity. Tang emphasized that a broad background in several scientific fields may increase the creative powers of scientists because it will allow them to make novel connections (quoted by Liang, 2002). Science achievement and content knowledge is a

considerable factor when describing scientific creativity. In scientific creative activity, it is very considerable to understand the role of knowledge in students' scientific creativity.

Scientific creativity and diversity are crucial for the future of our educational system. A fair amount of research has been carried out to study the correlation between scientific creativity and various variables like Cognitive Style, Achievement in Science and Gender. But the present studies on the subject are not enough to substantiate the influence of these variables on scientific creativity of secondary school students. The absence of a concrete research design to quantify these correlations made it imperative to bridge the existing gaps by undertaking the present study.

Method :

For the selection of the sample, the cluster random sampling technique was used. The sample was selected by keeping in mind the objectives of the study. The population, from which the sample of schools was selected, was schools affiliated to Central Board of Secondary Education.

Measures :

In the present study, data was collected by administering the following tests:

1. Majumdar Scientific Creativity Test by S.K. Majumdar. (1982).
2. Group Embedded Figures Test by Herman A. Witkin, Philip.k. Oltman, Evelyn Ruskin, Stephem. A. krap. (1971).

Instructions for scoring as outlined in the manual were followed. Since no literature on grouping in GEFT according to Indian standards was available, so the groups were assigned at two levels viz-below and above calculated mean value of 12 obtained from present observations. Those above mean were categorized as field independent and those below mean as field dependent.

Scores of students in Science Subject were obtained from respective schools. Scores were then expressed as percentages. Students were further categorized into three levels namely, high, medium and low on the basis of Mean+/- Standard Deviation. Grouping for Achievement in Science was done on the basis of above formula. Scores were grouped at three levels mainly High, Intermediate and Low. Scores lying in range of 40-75 were grouped as Intermediate. Scores below 40 were clubbed under low level and scores above 75 as high.

At two levels for gender**,** males were assigned code 2 and females were given code 1.

Design: Data was analyzed objective – wise by using ANOVA.

Interpretation

TABLE- 1: Summary for 2×3 factorial design for influence of Cognitive Style, Achievement in Science and their Interaction on Scientific Creativity of Secondary School Students

Source of Variance	Sum of Squares	df	Mean Squares	F-Value
Cognitive Style (A)	292	1	292	0.637
Achievement in Science (B)	91124.25	2	45562.12	99.36**
A×B	611.82	2	305.911	0.67
Error	69698.55	152	458.54	
Corrected Total	170259.27			

** Significant at 0.01 level

TABLE -2: Summary for 2×2 Factorial Design for Influence of Cognitive Style, Gender and Their Interaction on Scientific Creativity of Secondary School Students

Source of Variance	Sum of Squares	df	Mean Squares	F-Value
Cognitive Style (A)	3377.78	1	3377.78	3.45
Gender (B)	12983.30	1	12983.30	13.250**
A×B	58.72	1	58.72	0.06
Error	150898.95	154	979.86	
Corrected Total	170259.27			

** Significant at 0.01 level

Discussion: In present investigation, Scientific Creativity of secondary school students was found to be independent of Cognitive Style. The results are cognizant with findings of Bhawalkar (1992), Singh (2001), Singh (1987) and Sharma (1981) who reported that degree of independency did not influence creativity significantly. Katra in 1993 also contested that in urban samples total scientific creativity was not significantly related with cognitive style.

Scientific Creativity of secondary school students was found not to be independent of Achievement in Science in present study. Significant correlations between scientific creativity and academic achievement have also been cited by Dubey (1994), Rajnish (1998) and Ndeke and Okerel (2012). Correlations between scientific achievement and scientific creativity were also reported as insignificant by Jaiswal (2008) and Bhawalkar (1992). However, in present research,

Scientific Creativity of secondary school students was found to be independent of interaction between Cognitive Style and Achievement in Science.

Sansanwal, Sharma and Deepika (1993) established that students' sex has no influence on scientific creativity whereas studies by Hunashal (2012), Ndeke and Okerel (2012), Kwatra (2000) revealed that scientific creativity is gender dependent. Shukla (1982) also attributed more creativity to males. This is in consonance with present study where Scientific Creativity of secondary school students was found not to be independent of Gender. However, Scientific Creativity of secondary school students was found to be independent of interaction between Cognitive Style and Gender.

Knowledge base that is content and context sensitive has to be effectively constructed with the help of facilitator**.** Teacher should try to use an experimental approach and engage the learner effectively. Designing experiments and improvisations should be encouraged among students. There are no shortcuts to creative learning in science. The overall approach should provide enough flexibility to provide for variety of learning and personality styles. Range of instructional methods such as discussion-questioning, individualized instruction, group investigation, Simulation role play, or inquiry can be used. Students learning needs should be taken into account with regard to their level of development and academic performance**.** Scientific creativity measures are influenced by gender differences. Cognitive styles vary across learners. Future research may dig out the causes of these differences and consolidate instructional measures to promote sound knowledge base.

Delimitations of the study :

1. The study was delimited to students studying in class IX and X.
2. The sample was confined to 158 students studying in class IX and X.
3. The present study was confined to public/private English Medium schools affiliated to CBSE Board, of SBS Nagar district.

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