

INVESTIGATION OF SCIENTIFIC CREATIVITY ON THE BASIS OF SCIENCE ACHIEVEMENT FOR THE SENIOR SECONDARY STUDENTS

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ABSTRACT

Present study was an endeavor to look into the relationship between scientific creativity and Science achievement level, with senior secondary school students in Bhopal India. Science plays an important role and it is recognized globally. Creativity is the chief component of science. Science and creativity work together innovatively and bring out positive changes. It means scientific creativity has the potential to change the scenario and faces the provocations one step ahead. In the present paper, the researcher wants to know the relationship between science and creativity and its effect on the student's achievement level. For this purpose three components of creativity (Fluency, Flexibility, and originality) are ushering with achievement. For this purpose, the researcher uses the verbal test of scientific creativity (VTSC) on the sample size of 80 students (40 male and 40 female) of class XII, Government and non-government schools of Bhopal Block. 40 girls and 40 boys are randomly selected. To know the difference between scientific creativity and science achievement mean, standard deviation and Independent sample, 't' test is used. To check the relationship between scientific creativity and science achievement Pearson correlation is computed. After analyzing the data the result signify that creativity is carrying great weight in relation to achievement. If we nurture creativity at the right point of time students will acquire scientific creativity which gives a positive impact on the achievement level.

KEYWORDS: Creativity, Science, Achievement, Education, VTSC, Fluency, Flexibility, Originality.

Introduction

'Scientific creativity has the potential to mastermind the scientific procedure, to determine the solutions smartly. As we know, creativity itself is an indispensable phenomenon, which leaves the path behind in every area of work. It plays a crucial role in dealing with every potential situation of today's frenetic life. An upbringing of generation with creativity is a need of the hour. This can be fulfilled by educational institutions because it is a place where children can excel beyond the limits with splendiferous abetments. That achievement motivation has a significant positive relation with creativity (Ghasemi, Rastegar, Jahromi, & Marvdashti, 2011). In the academic world to take the scientific creativity to its zenith, we should create a meaningful relation between science and creativity and construct a link between the two. At the end this will help in bridging the gap between facts and imagination. This will help in developing problem solving capacity of a learner and help them acquire high order thinking. Scientific creativity can be a novel approach to learning style because divergent thinking is the unique feature for the process of creativity. Which is radical, without attainment of originality, creativity is not at all feasible. For this reason creativity is the 'stroke of the intellectuals'.

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The Successful novel problem solver operates through intuitive function and they always attend cognitive and non cognitive elements in science (Aldous, 2007). Scientific creativity is not only concern about contrivances, although it has a holistic approach which includes cognition as well. The point of fact is scientific creativity prevails with analytical power to bring positive refinements among the learners. For the acquaintance of a better tomorrow today's generation should be equipped with excellence of knowledge and all sorts of right skills. The education sector is going through enormous changes in our country. For its vivid future immense changes are seems to be continuing vibrantly with many expansions and array of themes and issues pace together to further transform education landscapes for better education system. The quantum benefits for the learners are that, they must occupy the highest level of learning ecosystem. The facilitators are at the chief component of an ecosystem. This can be improved by fostering creativity among the learners. A continued spotlight on the development of creativity through rigorous training program with creative modules can help them to reach the heights of the success in the learning ecosystem. In order to expand reach of creativity in education, it's become vital for learning. Scientific creativity and education has the capability to change the face of learning. In the country like India where more stress is given to the elevation of the primary and secondary education, the demand of the future is that we should keep up the pace of upliftment and should try to bring new and advance changes to enhance educational strategies. This gives the profound thought process towards the cognitive domain of the students for the intellectual upliftment. Many studies put emphasis on the old traditional methods but it cannot match the potential of today's learners and their calibre. It is mere rote learning far away from the pragmatic educational demand of today's generations. Scientific creativity can be developed by using planned strategies and techniques (V. Sharma).As it plays a vital role in almost every sector of education which is like a path finder to the new world, with learner's own pace. This freedom stimulates students for self learning from common rote learning techniques. So creative learning has seeped into the learning system to give positive impact on all domains of the learners. In this process most important thing is, the content which is delivered in the class should enable the students for optimum learning outcomes. This process should be a student centric. This enables the students for contextual learning which clear the concept of learners up to great lengths. If this approach can be accessible this will bring tremendous change in present learning system. As we discussed the genesis of creativity is pivotal. Scientific creativity develop only when divergent thinking process is getting into the nerves of the learner's and they start becoming the leading edges because everyone is concerned about how to develops creative talent? The Main concern of the educationist is to cultivate knowledge driven society, scientific creativity is the foundational urge of today's novice. Science education can foster the imagination and creativity among the science students. In review of literature found that Scientific creativity can be fostered by using different types of teaching techniques Raj Hans, Saxena, Rani deepa (2016). In empirical support has been found for the relationship between aspects of creativity and academic achievement (Sayadian & Lashkarian, 2015). According to the National Policy on Education 2016, reiterate the role of education in inculcating the value with education, hence Parents and academic institutions are corner stone's of learning.

Creativity in Science

Science is a subject where students get original experiences; it is capable to generate new ways of teaching and learning to construct new knowledge with deductive reasoning because rational opinion leads toward tomorrow's development. The top bodies of creative education understand that creativity can be nurtured by the use of correct things at the right time. Science education collaborates theory with practical's therefore students have opportunity, to identify challenges and bring out the solutions by the use of existing knowledge, practical exposure provides an insight of correctness. Communication skill will help in increasing creativity of the students. Science means acculturation of education among the students to brace new information's in the light of insight, to attain this challenging world. Science learners intuitively comprehend the attainment of maxims of science they can answer the concepts, logics, and explain the theory behind the logics. They can ameliorate the relationship between science, ICT(Information Communication Technology) and creativity, and use it for the betterment of the mankind. Scientific refinements are the capability of the learners is to:

- Develop a scientific attitude.
- Make them understand about conceptual knowledge of science.
- Enable the learner's inquiry approach, and scientific temperament to deal with the situations.
- Captivate the students in meaningful learning, to enhance their fortitude towards real world because it is the need of the hour is to develop scientific skilled learners.
- Persuade learning for gaining knowledge and its applicability to individual and community.

Imagination and creativity are considered the central to the nature of the science (Hadzigeorgiou, Fokialis, & Kabouropoulou, 2012). Epistemology of science means the generation of factual base ideas, with innovations. Creativity is context dependent creativity means to coap up with unaccustomed view points, they may precious as well as useful for the contemporary society (Ferrari, Cachia, & Punie, 2009). Scientific creative approaches have an explicit relationship with ingenuity. This can provide the learners with original concepts conjointly excel exposure to new areas of the subject. It is providing pavement to create meaningful relations with rest of the areas of the knowledge. It permits intelligible unobstructed and persistent efflux of concept. Furthermore science puts more emphasis on developing better acquaintance within a subject. There is no decline in student's interest in pursuing science many of them wish to pursue science as a main stream (Chunawala & Natarajan, 2011). Because it imparts the conceptual approach towards real life situations in collaborate it with creativity and technology. Science can bridge the gap of the real learning situation by creating virtual classrooms, virtual activity is actually capable of creating a positive mind in order to use their minds and creative teaching practice is an important element to achieve the objectives of educational institutions in better manner (Daud, Omar, Turiman, & Osman, 2012). So anyone can learn anything anytime beyond the boundaries, now the key of content is in learner's hand. This can update them and concentrating on minimizing the conceptual defect and put forth abundant opportunities for excellence, and it is expected that students can bloom well in the scientific world.

Achievement in Science

Achievement is the way to know about the individual's progress. It provides detailed analysis about the preparation to achieve goal/ target. It is evolutionary in nature. This gives a clear picture of learning. It is a two way communication teacher and learner both are involve and accountable, and it provides a mirror image of students and their teacher, motivation, reinforcement, positive stimulation is the key term which may affect the level of achievement. Positive and high level relationship has been found between creativity and motivation (KHAN & RIZWANUDDIN). With the help of motivation, we can influence students learning capacity in a positive manner. There is an adequate possibility in science education to promote and persuade creativity which gives optimistic effect on academic achievement (Pramendra Honey). Students with High Achievement in Science had significantly higher scientific creativity than students with Low Achievement in Science (N. Sharma, 2015). Practical approach work significantly in Biology, as the development of process skill was higher in the students who were taught by laboratory approach (Yadav & Mishra, 2013). Achievement plays very important role in science learning and creativity because learners have gone through by thought process, and anyone cannot learn science without divergent thinking. Which is radical for creative learning? All the Tasks of scientific creativity had a positive influence over achievement in science (Swamy M.Narayana, Ramesha 2013). Many research states that scientific creativity has a positive relationship with science achievement. Scientific creativity has positive relationship with achievement (Bolandifar & Noordin, 2013) (Aktamis & Ergin, 2008). Different activity deals with scientific creativity in various pattern and serve different purpose, which means each activity has its own value for dealing with a particular kind of information. Different aspect of creativity and academic achievement doesn't matter males and females when looking at the relation between creativity and academic achievement (Candrasedkaran, 2013). Students' positive attitudes to science subjects correlate highly with their science achievement and that improved students' attitude to science subjects will enhance students' performance in the subject (Agbaje, Rashidat O, & Alake, Ese M 2014).

Hypotheses of the Study

- **H₀** There is no interaction between factor components of scientific creativity and school types.
- **H₁** There is an interaction between factors components of scientific creativity and school types.
- **H₀** There is no significant relationship between scientific creativity and science achievement of girls and boys of XII standard Government and non government school students of Bhopal city.
- **H₁** There is a significant relationship between scientific creativity and science achievement of girls and boys of XII standard government and non government school students of Bhopal city.
- **H₀** There is no significant relationship between scientific creativity and science achievement of girls and boys of XII standard Government school students of Bhopal city.
- **H₁** There is a significant relationship between scientific creativity and science achievement of girls and boys of XII standard Government school students of Bhopal city.

- **H₀** There is no significant relationship between scientific creativity and science achievement of girls and boys of XII standard non government school students of Bhopal city.
- **H₁** There is a significant relationship between scientific creativity and science achievement of girls and boys of XII standard non government school students of Bhopal city.

Objectives of the Study

- To study the interaction between factor components of scientific creativity and school types.
- To study the significant relationship between scientific creativity and science achievement of girls and boys of government and non government schools of Bhopal city.

Delimitations of the Study

- Present research work confined to Bhopal city only.
- This research work limits to government and non government school only.
- This research work is the output of XII standard school students only.
- Researcher talks about scientific creativity and science achievement only.

Design of the study/Experimental Set Up

This study was a descriptive method of research. The target population of the study is comprised of XII science, of one government and one non government senior secondary school of Bhopal city, India. The stratified random sampling technique was used to select the sample of 80 students, in which 40(boys)and 40(girls) are selected. To know about the level of scientific creativity among the student researcher conducts surveys in selected schools of Bhopal city. In order to test the hypothesis. The researcher planned the investigation and completed it in three phases. In the first phase researcher reviewed the related literature and research work. To measure the level scientific creativity among the students, Verbal Test of Scientific creativity (VTSC) has been chosen. This was developed by Dr V.P Sharma, and Dr. J.P. Shukla. To know about the science achievement of the students, Midterm exam marks was used as an alternate for their scholastic achievement. This is hinged on their terminal examination result. Scholarly achievement means the total marks of student get in particular subject in particular exam. Before administration of tool, proper instructions are given to the students. Total 45 minutes are allotted for the completion of the test. With the help of this test three factors Fluency, Flexibility, and originality of scientific creativity have been taken for evaluation. Present test is built on 12 items which have been classified into four sub test namely (1)Consequences test(2) Unusual uses test (3) New Relationship Test (4) Just Think Why Test. For the computation of data appropriate statistical techniques like mean score, standard deviation, 't' test and correlation 'r' analyzed 0.05 level of significance with the help of the SPSS 24 version and 'R' software is used for the calculation of Anova.

Data Analysis

Table 1: The Distribution of Samples

S. No	Name of School	Boys	Girls	Total
1	Kamla Nehru Hr. Sec. School (Non Government)	20	20	40
2	Subhash School (Government)	20	20	40
Total		40	40	80

Table 2: Showing the Results of F (Anova) Test

Factors	D.f	Sum Square	Mean Square	F Value	P Value	Level of Significance
Components of Creativity and school type	1	618.49	618.49	4.26	0.04	0.05

Hence, the p value for the interaction between scientific creativity and the school types is 0.04 (significant), which indicates that the positive association has been found between scientific creativity and school type. This clearly states that scientific creativity and school type affect the student's achievement level. If students are getting good school type their scientific creativity will enhance and gives positive impact on science achievement.

Table 3 Showing significance of 'r' between scientific creativity and science achievement of senior secondary school students of Government and non Government school of Bhopal city.

Relationship	N	Df	r	p	Level of Significance
Scientific creativity & Academic achievement	80	78	.165	.144	0.05

The value of 'r'.165 is to be found significant at 0.05 level of significance. Hence a null hypothesis is rejected. That means there is a positive significant relationship has been found between

scientific creativity and science achievement. It clearly depicts that if students possess better scientific creativity then greater will be the science achievement.

Table 4 Showing significance of 'r' between scientific creativity and science achievement of senior secondary school student's of government school of Bhopal city.

Relationship	N	Df	r	p	Level of Significance
Scientific creativity & Academic Achievement	40	38	.266	.098	0.05

The value of 'r'(.266) is to be found significant at 0.05 level of significance. Hence a null hypothesis is rejected. That means there is a positive significant relationship has been found between scientific creativity and science achievement of Government school students of Bhopal city. It clearly depict that if students learn better with scientific creativity then it gives positive response to science achievement and creation of greater learning atmosphere will be possible .

Table 5 Showing significance of 'r' between scientific creativity and science achievement of senior secondary school student's of non government school of Bhopal city.

Relationship	N	Df	r	p	Level of Significance
Scientific creativity & Academic Achievement	40	38	.144	.482	0.05

The value of 'r' (.144) is to be found significant at 0.05 level of significance. Hence a null hypothesis is rejected. That means there is a positive significant relationship has been found between scientific creativity and science achievement of non government school students of Bhopal city. Hence it can be said that Positive attitude towards science learning create better learning opportunities and that will reflect in the results as science achievement. From The above research findings exhibits that there was a affirmative (positive) correlation linking the scientific creativity and science achievement of the learners, which is statistically proven. This put forward for the consideration that high achievement in science tonned up the level of scientific creativity, this can be able to create positive ambience for science learning. These findings are advocated by some more findings of related research.

Implications

The conclusions of the research illustrate those learners academic achievement executes a positive role in accelerating the level of creativity in science. This is distinctly seen in the findings of the study. This showed explicit relationship between scientific creativity and academic achievement, therefore academic institutions should endeavor to promote students achievement in science, to entre at the science learning for better tomorrow.

Conclusion

It has become in appropriate when we are talking about the idea of scientific creativity, because cognition and comprehension are the basics of Science education, hence only science can give brainstorming ideas, which can create a quest for excellence. Therefore inevitable change in student's terminal behavior has been recognized. This may lead to cardinal changes in the skills of the scientific creativity among the students. Science achievement is directly related to scientific attitude that means with higher scientific attitude students have a better scope of achievement and that improved student's attainment (Agbaje & Alake, 2014). Every student is intellectual with incomparable grasping power, artistry, and learning capacity. Meta analysis or cognitive skills are very important for evaluation purpose to relinquish the base of achievement in science.

Suggestions

Communities are shifting from materialistic economic to innovative world. That means, Science and creativity has the potential to toned up the education for future generations. Creativity is the only instrument that enables today's students to cope with the uncertainties of the future (Pecheanu & Tudorie, 2015). To accommodate the learners with better facilities for the cultivation of creativity is the accountability of all the eminent like policy makers, educationist, and researchers. All have to work hard according to the need of the hour, and then only we are able to weave the better future. For this we have to develop a positive link between Students engagement in terms of their interest, self-potency, and confidence level. Scientific creativity has a positive influence on science achievement (Zeidan & Jayosi, 2014)(Swamy, 2013). That means scientific creativity can shape the academic achievement of the students, for that development of high order thinking skill is an essential requirement of creativity, to make sustainable changes in their traits Neoteric ways are obligatory.

To foster the creativity among the school going students, we have to pave the way with modern techniques, to break new grounds in the area of learning. The education system should provide proper atmosphere and shape up the facilities in a manner to encourage teaching and learning either aggrandize, cherish, or reinforced.

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