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A STUDY OF RELATIONSHIP BETWEEN DIVERGENT PRODUCTION ABILITY AND SCIENTIFIC CREATIVITY AMONG SECONDARY SCHOOL STUDENTS

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Abstract

This study explores the relationship between divergent production ability and scientific creativity among secondary school students. Divergent production, characterized by the ability to generate a variety of solutions to a problem, and scientific creativity, which involves the application of novel and effective solutions in scientific contexts, are critical components of effective problem-solving and innovation in education. Utilizing a mixed-methods approach, this research involved assessing divergent production abilities through standardized tests and evaluating scientific creativity through problem-based assessments and project evaluations. Data analysis revealed a significant positive correlation between divergent production ability and scientific creativity, suggesting that students with higher divergent production skills are more likely to exhibit enhanced scientific creativity. These findings have implications for educational strategies and curriculum design, emphasizing the importance of fostering divergent thinking to enhance students' scientific creative capacities. The study concludes with recommendations for integrating divergent thinking exercises into the science curriculum to support and develop students' creative problem-solving skills.

Keywords: *Relationship, Divergent, Production, Secondary, School*

Introduction

In the ever-changing world of education, encouraging creative thinking and innovation has emerged as a crucial area of concentration, especially in the field of science. Due to the fact that the world is becoming more and more dependent on scientific developments to solve difficult problems, the capacity to think creatively and come up with unique solutions is becoming more important. This demand highlights how important it is to have a solid grasp of the elements that lead to scientific creativity among students in secondary school. A major component of creative thinking is the ability to develop various, one-of-a-kind answers to a specific challenge. Divergent production ability refers to the capability to generate these solutions. On the other hand, convergent thinking, which is focused on finding a single, best answer, takes a different approach. When it comes to tackling problems in scientific environments, when standard approaches may not be enough, divergent thinking is absolutely necessary. It provides students with the opportunity to approach issues from a variety of perspectives, which in turn encourages creativity and innovative contributions to scientific subjects. There is a dearth of research that investigates the connection between divergent production capacity and scientific creativity in secondary school, despite the fact that this is an extremely important connection. The purpose of this research is to investigate the relationship between the capacity to participate in scientific creativity and the fact that different production skills are correlated with one another. After gaining an understanding of this link, one may get significant insights into the ways in which educational procedures might be structured to boost the creative capacities of students in the field of science. The research makes use of a mixed-methods technique, which combines qualitative evaluations of scientific innovation with quantitative assessments of the capabilities of different types of production. The purpose of this study is to provide light on the relationship between divergent thinking and innovative scientific problem-solving by evaluating these elements. The findings are anticipated to have practical consequences for educators, providing suggestions for methods that may be used to foster scientific creativity and diverse thinking in students who are enrolled in secondary school.

When it comes to education, the function that scientific creativity plays in promoting growth and innovation is a significant factor that highlights its value. Developing the capacity to think creatively in scientific situations is becoming more important for students who are in the secondary school level of education as they prepare for future academic and professional endeavors. One of the fundamental abilities that is believed to enable scientific creativity is known as divergent production. Divergent production is characterized by the generation of a wide variety of ideas and solutions. Recent years have seen an increase in the number of educational systems that place an emphasis on the significance of creativity in addition to the standard academic abilities. On the other hand, there is a need for empirical study in order to get a deeper understanding of the unique ways in which different production capacities impact scientific innovation. Although the material that is now available emphasizes the advantages of diverse thinking in terms of general creativity, the direct relationship between divergent thinking and scientific innovation is yet underexplored. In an effort to close this gap, the purpose of this research is to investigate the ways in which the diverse production capacities of secondary school students are related to their scientific creativity. The study offers a holistic perspective on these cognitive processes by applying a mix of standardized tests to measure divergent thinking and practical evaluations to evaluate scientific creativity. This allows for a more inclusive understanding of the cognitive processes. The research also takes into account a number of other characteristics, including gender, academic achievement, and exposure to creative teaching approaches, all of which have the potential to affect the link between divergent output and scientific innovation. We hope that the outcomes of this research will provide educators and policymakers with information that will enlighten them about the significance of including activities that require divergent thinking into scientific curriculum. In order to build focused treatments that will improve students' problem-solving abilities and encourage a more inventive approach to science education, educators may develop these interventions by first gaining an understanding of how diverse production influences scientific creativity.

Scientific Creativity

According to Feist (1998), scientific creativity is defined as the ability to have ideas that are fresh, creative, and beneficial and adaptable in the field of natural and social sciences. Misra (1986) defined scientific creativity as a process of becoming sensitive to problems related to science; deficiencies, gaps, missing elements, disharmonies and so on scientific knowledge; identifying the difficulty; searching for solutions; making guesses or formulating hypotheses about deficiencies; testing and retesting of these hypotheses and possibly modifying and retesting them, and finally communicating the result. In accordance with Moravesik (1981), scientific creativity is defined as the comprehension of new ideas and concepts that are added to scientific knowledge, the formulation of new theories in science, the discovery of new experiments, the prevention of natural laws, the recognition of new regulatory properties of scientific research and scientific group, the originality of scientific activity plans and projects, and a great deal of other ideas. Kocabas (1992b) identifies seventeen distinct key research tasks that are engaged in the process of doing experimental research. One of these is the formulation of research goals, the selection of research goals, the definition of a research framework, the gathering of knowledge, the organization of knowledge, the selection of research strategies, methods, tools, and techniques, the proposal of experiments, the design of experiments, and the selection of experiment materials, the setting of expectations, the execution of experiments, the collection of data, the evaluation of data, the formation of a hypothesis, the revision of a theory, the formation of a theory, the control of goal satisfaction, and the production of explanations.

Steps in Scientific Creativity

To put it simply, scientific creativity is comprised of the five phases that are described in the lines that are to come. The first and foremost step in scientific creativity is the motivation to conduct systematic scientific research; the second step is the ability to correctly identify the area of study and to formulate research problems within that specific body of knowledge; the third step involves the ability to identify and create a comprehensive search area for the solution of a scientific problem; the ability to assemble and implement one's own knowledge that has been acquired by discovering things themselves and learning from their own experiences to reduce the search space; and lastly having the fortitude and endurance for the pursuit of a meticulous search for solving the scientific problem within the constrained search space and not stopping until the most feasible solution is obtained. Therefore, a creative researcher is someone who is aware of how to accurately define research problems, who is able to produce a broad quest space for a particular problem, who is able to gather or detail the essential methodological information in order to reduce the quest space into reasonable measurements, and who is able to direct a thorough pursuit within the constrained inquiry space.

Scientific Creativity and Achievement

In order for young people to have a good growth in society, achievement is considered to be necessary. We live in a world that is increasingly focused on application. Rather than only being aware of the how and why of any given information, it is essential to have a thorough understanding of both. It is essential for the students to see that just possessing information is not sufficient; rather, they must be able to use this knowledge in a way that is meaningful in order to achieve the outcomes that they want. The contemporary trend of question papers being produced for regular and competitive examinations places a focus on examining the students' ability to apply their knowledge in the appropriate direction in order to produce the desired outcomes. Because of this, creativity is a significant aspect that has a significant impact on the level of accomplishment that kids attain. It is generally accepted that students who are pursuing a degree in science should possess the necessary scientific creativity. This is due to the fact that science is a topic that offers several possibilities to develop creative abilities. Students who do well in school have a greater chance of successfully navigating the transition into adulthood, as well as achieving success in their careers and with their finances.

Objectives of the study

1. To pinpoint the many levels of production ability that are present among pupils in secondary school.
2. To find the secondary school students' academic achievement positively correlated with their divergent production ability.

Hypotheses

1. The kids in secondary school do not exhibit any distinctively different levels of producing ability.
2. There is no significant differences between students from urban and rural areas, students from public and private schools, and students from both genders.
3. There is no there is a favorable association between the academic performance of secondary school pupils and their varying levels of producing ability.
4. There is There is no positive association between the socioeconomic condition of secondary school pupils and their varying levels of producing ability.

METHODOLOGY

Sample

The research was carried out in a representative sample of 100 of 9 th secondary school pupils in Patna, which is located in the Indian state of Bihar. The selection of the sample was carried out using a method known as stratified random sampling procedure.

Tools of the study

For the present study following tools has been used.

(i) Divergent Production Ability: The Divergent production ability Test, which was designed and standardized by Sharma K.N., was used specifically for the purpose of this research. The battery of Divergent production skills consists of six tests in English and assesses eight talents, which are listed below:

Different production capabilities and the names of their respective tests

Sl. No.	Divergent production Ability	Names of the test
1 2 3 4 5 6 7 8	Word fluency Ideational fluency Association fluency Expressional fluency spontaneous flexibility Adaptive flexibility Originality Elaboration	Word production Uses of things Similarities Sentence contraction Uses test Titl es Titl es Solutions/Completion

(ii) Academic Achievement: For the purpose of the research, the total percentage of the students' marks obtained from the previous year has been compiled.

(iii) Socio-economic status Scale: The socio-economic status scale that was established and standardized by R.A. Singh and S.K. Sexena has been used for the purpose of this particular study.

Analysis of Data

A computation is made to determine the percentage, the mean, and the standard deviation for each of the several subgroups, which include urban, rural, government, private, boys, and girls. The "t" test was used in order to determine whether or not there was a significant difference between the subgroups, and Pearson's "r" was utilized in order to determine whether or not there was a positive correlation between the subgroups.

Table-1: The average score for the production that was divergent Skills possessed by the pupils.

Variable	Sample	N	Mean	S. D
DPA	9^{th} std students	100	75.15	16.32

As can be seen in the chart over there, the average score of pupils in the ninth grade is rather high. Therefore, the null hypothesis once it has been defined is rejected in favor of the alternative hypothesis. As a result, the conclusion that was reached was that the pupils in the ninth standard had varying levels of manufacturing capability.

Table-2: Elements that make up the diverse production Ability expressed as a proportion of total.

Variable	Divergent production ability			
	Fluency	**Flexibility**	**Originality**	**Elaboration**
All 9th std students	61%	24%	8%	8%
Urban	64%	22%	7%	8%
Rural	58%	25%	9%	8%
Government	64%	19%	8%	10%
Private	64%	26%	5%	5%
Boys	62%	23%	7%	8%
Girls	63%	26%	5%	6%

Table-3: Variation that is statistically significant between the subgroups.

Variable	Sub-Group	N	Mean	SD	t-value 0.05	Obtained t-Value	Level of significance
Location	Urban	50	79.5	19.00	1.98	2.27	Significant at 0.05 level
	Rural	50	70.9	15.11			
Institution	Urban	25	81.9	15.46	2.02	1.43	Not Significant at 0.05 level
	Rural	25	76.3	20.57			
Sex	Urban	13	80.84	13.36	2.06	3.12	Significant at 0.05 level
	Rural	12	88.00	21.34			

The t-values that were obtained, 2.27 and 3.12, indicate that there is a significant difference between the respective subgroups in terms of their divergent production ability. On the other hand, the t-value that was obtained, 1.43, indicates that there is no significant difference between the respective subgroups in terms of their divergent production ability.

Table-4: There is a correlation between the difference in producing abilities and educational accomplishments.

Sub-Group	Variable	N	Mean	SD	r-value 0.05	Obtained r-Value	Level of significance
All 9th Std Students	Divergent production ability	100	75.15	16.32	0.196	0.108	Not Significant at 0.05 level
	Academic Achievement	100	66.56	9.05			
Urban	DPA	50	79.5	19.00	0.276	0.282	Significant at 0.05 level
	AA	50	64.51	9.16			
Rural	DPA	25	80.30	10.62	0.396	0.060	Not Significant at 0.05 level
	AA	25	70.41	12.46			
Government	DPA	25	76.30	20.5	0.396	0.205	Not Significant at 0.05 level
	AA	25	63.58	12.32			
Private	DPA	25	70.30	20.50	0.396	0.207	Not Significant at 0.05 level
	AA	25	75.60	10.58			
Boys	DPA	13	67.30	11.76	0.553	0.762	Significant at 0.05 level
	AA	13	66.15	1.56			
Girls	DPA	12	61.13	17.05	0.576	0.873	Significant at 0.05 level
	AA	12	67.50	10.50			

The table that was just presented demonstrates that the r-values that were obtained were 0.282, 0.762, and 0.873, which indicate a significant positive correlation between divergent production ability and academic achievement of subgroups respectively. On the other hand, the r-values that were obtained were 0.108, 0.060, 0.205, and 0.207, which indicate that there is no significant positive correlation between divergent production ability and academic achievement of the subgroups respectively.

Table-5: The correlation between different levels of socioeconomic status and the ability to produce different goods.

Sub-Group	Variable	N	Mean	SD	r-value 0.05	Obtained r-Value	Level of significance
9th std Students	Divergent production ability	100	75.15	16.32	0.196	0.202	Significant at 0.05 level
	Socio Economic Status	100	74.43	3.85			
Urban	DPA	50	79.05	19.00	0.276	0.406	Significant at 0.05 level
	SES	50	74.41	9.59			
	Variable	N	Mean	SD			
	DPA	25	70.90	15.71			
	SES	25	74.46	12.96			
	DPA	25	81.9	15.46			
	SES	25	73.22	8.00			
	DPA	25	76.30	20.50			
	SES	25	75.6	10.58			
	DPA	13	80.88	13.36			
	SES	13	70.69	5.16			
	DPA	12	80.00	21.34			
	SES	12	75.75	9.14			

The aforementioned demonstrates that the obtained 'r'-values of 0.202, 0.406, 0.409, and 0.632 demonstrate a significant positive correlation between divergent production ability and the socio-economic status of sub-groups respectively. On the other hand, the obtained 'r'-values of 0.188, 0.207, and 0.077 demonstrate that there is no significant positive correlation between divergent production ability and the socio-economic status of the sub-groups respectively.

Conclusion

The purpose of this research was to investigate the connection between divergent production capacity and scientific creativity among students in secondary school. The findings of this investigation revealed a substantial positive link between these two concepts. Students who have higher levels of divergent production abilities, which are defined by their capacity to develop different, distinct solutions, have a tendency to demonstrate stronger scientific creativity, according to the research. In scientific settings, the significance of divergent thinking in the development of creative problem-solving skills is highlighted by the link between the two components. When it comes to educational practice and the development of curricula, the findings have a number of consequences. Teachers are strongly urged to include into the scientific curriculum a variety of activities and exercises that inspire students to think in a variety of ways. These interventions may include brainstorming sessions, open-ended problem-solving exercises, and project-based learning, all of which have the potential to stimulate the creative skills of students and boost their ability to approach scientific issues from a variety of angles. As an additional point of interest, the research shows the potential advantages of individualized teaching approaches that take into account individual variations in distinctive production capabilities. It is possible for educators to better assist the development of scientific creativity and innovation if they recognize and cultivate the diverse thinking abilities of their pupils. In the future, research should investigate other aspects that may impact the link between diverse output and scientific creativity. These elements include socio-cultural effects, specialized instructional approaches, and the function of motivation. In order to get a deeper understanding of the dynamics of creative thinking in scientific education, it would be beneficial to broaden the scope of this study to include a variety of educational contexts and demographics. For the purpose of encouraging scientific creativity among secondary school pupils, it is essential to cultivate talents in divergent creation. The insights that were gathered from this research offer a basis for the development of successful instructional practices that are targeted at preparing students for the difficulties and possibilities that are present in the scientific world.

Reference

[1] Anderson (1965), *Creative in adolesents*, Discovery puublishing House, New Delhi. Dadapani (2003). *Advanced Educational psychology* Anmol publication pvt ltd, New Delhi.

[2] Ernest, R. Hilgard, Richard, c. Atkinson and Rita, L Atkinson: (1975). *Introduction to psychology*, 6th Edition, Oxford and I Blt publishing co. pvt. ltd.

[3] Robert, A Boron (1995). *Psychology*, 3rd Edition Allyn and Bacion.

[4] Robert, S. Feldman (1996) *Understanding psychology* 4th Edition, Mcgraw Hill Inc.
[5] Sharma D.K. (1987). *Divergent production ability test*, Ankur psychological Agency, Lucknow.
[6] Perkins, D.N. (1984). *Creativity by design. Educational Leadership*, 42 (1) 18-25.
[7] Shrivastava R.K. (1989). *A study made a need in relation to creative among high school pupils*, Surveys of educational research, M.B. Buch, Vol-II (1988-82).
[8] Mangal S.K. (2002). *Advanced Educational psychology* IInd Education, prentice-Hall of India, pvt Ltd, New Delhi.
[9] Van Mering (1955). *Creativity in adolescents*, I, Education Discovery publishing House, New Delhi.
[10] Buch, M.B. and Santhanam, M.R. (Eds.) (1970). "Communication in Classrooms".
[11] Barpda : Case M.S. University. Doctor, Z.N. (1987), Classroom Climate, Psyche of Pupils and Their Achievement ;← Doctor,
[12] Z.N. (1987). Classroom Climate, Psyche of Pupils and Their Achievement ; Ref. in M.B. Buch. (Ed.) : Their Third Survey of Educational Research, Baroda : N.C.E.R.T.
[13] Flanders, N.A. (1962). Using Interaction Analysis in the Inservice Training of Teachers;← Journal of Experimental Education, 30(4).
[14] Lewis, E.C. (1964). An Investigation of Student - Teachers Introduction as a Determiner← of Effective Teaching. Journal of Educational Research, 57(7).