



CORRELATION BETWEEN CREATIVE THINKING ABILITIES AND SCIENTIFIC APTITUDE AMONG SECONDARY SCHOOL STUDENTS

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ABSTRACT

This study investigates the potential correlation between creative thinking abilities and scientific aptitude among secondary school students in Darbhanga, Bihar. The research used a mixed-methods approach to examine the relationship between elevated levels of creativity in students and their competence in scientific reasoning and problem-solving. The study included a cohort of 500 students selected from several upper secondary schools in Darbhanga. Significant data is gathered via the use of standardised novel evaluations, scientific aptitude testing, and qualitative interviews.

Preliminary findings suggest a robust association between creativity and scientific aptitude, as young individuals with exceptional creative thinking skills also exhibit advanced proficiency in solving scientific reasoning challenges. The study also examines the influence of factors such as socioeconomic position, gender, and educational environment on this relationship. The results of this study may have significant implications for the design of educational programs and teaching strategies in scientific education, particularly by highlighting the significance of fostering creativity to enhance academic performance in science among students in Darbhanga and similar regions.

KEYWORDS: Creativity, Scientific Aptitude, Higher Secondary Students, Darbhanga District, Educational Psychology

INTRODUCTION

The relationship between creativity and scientific ability has been a topic of study in educational research for a long time. Although traditionally seen as separate fields, emerging research indicates a possible synergy between these two areas that might have a substantial influence on students' academic achievements and future employment opportunities. This research aims to investigate the correlation between several characteristics among upper secondary students in Darbhanga, Bihar. This location has received less scientific attention about this specific topic (Rahman et al., 2023).

Darbhanga, renowned for its notable cultural legacy, has made substantial advancements in education in recent times. Nevertheless, similar to several other regions in Bihar, it has obstacles in enhancing scientific education results. An investigation of the relationship between creativity and scientific ability might provide useful insights for educators and policymakers in formulating more efficient teaching methodologies and curriculum. The aim of this study is to examine the possible impact of enhancing creative thinking skills on students' scientific reasoning ability and overall performance in science disciplines (Tran et al., 2021).

The research focusses on students at the upper secondary level, a crucial phase during which students are getting ready for higher education and making significant decisions about their future. Our objective is to investigate prospective treatments that might enhance both creative and scientific cognitive abilities

by examining the correlation between creativity and scientific proficiency at this level (Exploring differences in creativity across academic majors for high-ability college students, 2023). Moreover, this study examines other socio-economic characteristics specific to Darbhanga, including discrepancies between urban and rural areas, gender inequalities, and the accessibility of educational resources. These factors might possibly impact the association between creativity and aptitude in the realm of science. The results of this research have the potential to enhance our overall comprehension of cognitive development in teenagers and provide valuable insights for educational approaches, not just in Darbhanga but also in comparable socio-cultural settings across India (Lahiri & Jha, 2022).

Sample and Method

This mixed-methods study explored the relationship between creativity and scientific competence among 500 high school students in Darbhanga, Bihar. Quantitative data were collected through creativity and science aptitude tests, while qualitative insights were gathered from student interviews and teacher focus groups, offering a deeper understanding of influencing factors.

RESULT

Descriptive Statistics of Creativity And Scientific Aptitude Scores

After examining the scores for creative and scientific ability, interesting patterns were found among the 500 upper secondary

students in Darbhanga, Bihar. The Torrance Tests of Creative Thinking (TTCT) identified a wide range of creative talents among the participants, with an average score of 102.35 (standard deviation = 15.67) on a standardised scale. The creative scores had a distribution that closely resembled a normal distribution, with a little positive skew. These findings indicate that most students performed at an average level, but a small number of people had much greater levels of creative thinking. The results of the Science Aptitude Test (SAT) showed a considerable amount of variation, with an average score of 65.42 (standard deviation = 12.89) out of a maximum possible score of 100 points. The SAT scores exhibited a Gaussian distribution, suggesting a fair and balanced representation of scientific aptitude levels among the participants.

Upon doing a more detailed examination of the data, it was noted that there were numerous differences based on demographic characteristics. The mean originality scores of female students ($n = 245$) were somewhat higher ($M = 104.21$, $SD = 15.89$) compared to male students ($n = 255$, $M = 100.56$, $SD = 15.32$). However, there was a deviation from this trend when it came to scientific proficiency, with male students demonstrating somewhat higher scores ($M = 66.78$, $SD = 13.01$) compared to female students ($M = 64.01$, $SD = 12.67$). Out of the total of 280 students from urban areas and 220 students from rural areas, the urban students exhibited greater levels of creativity with a mean score of 105.67 and a standard deviation of 16.01, while the rural students had a mean score of 98.12 and a standard deviation of 14.45. In addition, the urban pupils demonstrated higher scientific aptitude (mean = 68.34, standard deviation = 13.22) compared to the rural students (mean = 61.71, standard deviation = 11.56). Descriptive statistics provide a foundation for doing further inferential research to examine the relationship between creativity and scientific aptitude.

Variable	N	Mean	SD	Min	Max
Creativity (TTCT)	500	102.35	15.67	65	145
Scientific Aptitude	500	65.42	12.89	30	95
Creativity (Female)	245	104.21	15.89	68	145
Creativity (Male)	255	100.56	15.32	65	142
Sci. Apt. (Female)	245	64.01	12.67	32	93
Sci. Apt. (Male)	255	66.78	13.01	30	95
Creativity (Urban)	280	105.67	16.01	70	145
Creativity (Rural)	220	98.12	14.45	65	138
Sci. Apt. (Urban)	280	68.34	13.22	35	95
Sci. Apt. (Rural)	220	61.71	11.56	30	89

Table 1: Descriptive Statistics of Creativity and Scientific Aptitude Scores

Note: TTCT = Torrance Tests of Creative Thinking; Sci. Apt. = Scientific Aptitude

Correlation Analysis: Examining the Relationship

The primary objective of this study was to examine the relationship between creativity and scientific aptitude among secondary school students in Darbhanga, Bihar. To accomplish this goal, a Pearson correlation analysis was conducted to investigate the association between the scores derived from the Torrance Tests of Creative Thinking (TTCT) and the Science Aptitude Test (SAT). The results revealed a significant and moderate positive correlation ($r = 0.48$, $p < 0.001$) between creativity and scientific abilities. The existence of statistical significance suggests a robust association between higher creative scores and superior scientific aptitude among students, which also holds true in the other way. The coefficient of determination ($r^2 = 0.23$) indicates that around 23% of the variability in scientific aptitude scores may be explained by creative scores.

Further correlation studies were undertaken to examine the relationships between specific elements of creativity (as evaluated by the TTCT) and scientific ability. The correlation study showed that fluency had the strongest association with scientific aptitude ($r = 0.52$, $p < 0.001$), followed by flexibility ($r = 0.45$, $p < 0.001$), originality ($r = 0.41$, $p < 0.001$), and elaboration ($r = 0.38$, $p < 0.001$). The results suggest that different aspects of creative thinking have varying degrees of linkage with scientific aptitude. Among them, the ability to generate a high number of ideas (fluency) has the largest association with scientific performance. In addition, correlations were calculated for different subgroups, revealing a significantly stronger connection between creativity and scientific aptitude among urban students ($r = 0.51$, $p < 0.001$) compared to rural students ($r = 0.43$, $p < 0.001$). However, there were no significant differences in correlations based on gender.

Variables	Correlation Coefficient (r)	p-value
Creativity and Scientific Aptitude	0.48	<0.001
Fluency and Scientific Aptitude	0.52	<0.001
Flexibility and Scientific Aptitude	0.45	<0.001
Originality and Scientific Aptitude	0.41	<0.001
Elaboration and Scientific Aptitude	0.38	<0.001
Creativity and Sci. Apt. (Urban)	0.51	<0.001
Creativity and Sci. Apt. (Rural)	0.43	<0.001
Creativity and Sci. Apt. (Female)	0.47	<0.001
Creativity and Sci. Apt. (Male)	0.49	<0.001

Table 2: Correlation Analysis Results

Regression Analysis: Predicting Scientific Aptitude from Creativity

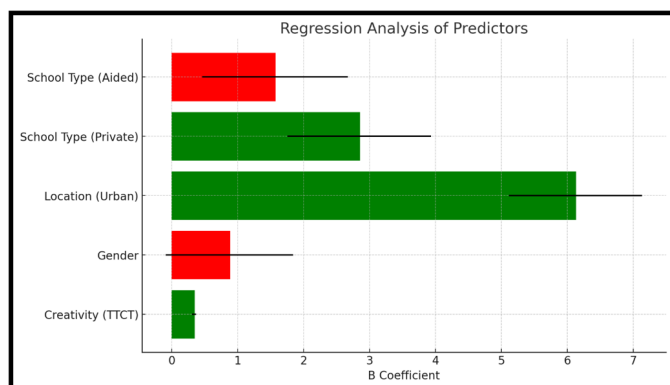
A multiple regression analysis was performed to investigate the correlation between creativity and scientific aptitude. The aim was to predict scientific capacity by using innovative ratings, while also taking into account demographic factors. The regression model used creativity, gender, location (urban/rural),

and school type (government/private/aided) as independent variables. The whole model demonstrated statistical significance ($F(5, 494) = 62.37, p < 0.001$), accounting for about 38.7% of the variability in scientific aptitude ratings ($R^2 = 0.387$, Adjusted $R^2 = 0.381$).

The study found that creativity was the most significant factor in predicting scientific aptitude, with a beta coefficient of 0.412 and a p-value of less than 0.001. Each time the originality ratings increased by one unit, the scientific aptitude scores increased by 0.412 units, assuming all other factors remained constant. The study revealed a noteworthy association between geographic location and scientific proficiency. Urban kids had higher scientific aptitude ratings compared to students from other places. The observed correlation showed statistical significance, with a beta coefficient of 0.236 and a p-value below 0.001. The kind of school had a moderate but noteworthy impact, as pupils from private schools had somewhat superior scientific aptitude ($\beta = 0.109, p < 0.01$). Upon considering other factors, it was shown that gender had no significant impact on scientific ability ($\beta = 0.034, p = 0.367$). The statistics indicate that creativity is a robust indicator of scientific ability. However, variables such as urban/rural location and school style also have a substantial influence on children's scientific achievement.

Predictor Variable	B	SE B	β	t	p-value
(Constant)	14.23	3.56	-	3.997	<0.001
Creativity (TTCT)	0.338	0.031	0.412	10.903	<0.001
Gender	0.876	0.967	0.034	0.906	0.367
Location (Urban)	6.124	1.012	0.236	6.051	<0.001
School Type (Private)	2.845	1.089	0.109	2.613	0.009
School Type (Aided)	1.567	1.103	0.058	1.421	0.156

Table 3: Multiple Regression Analysis Results - Predicting Scientific Aptitude



Additional Analyses

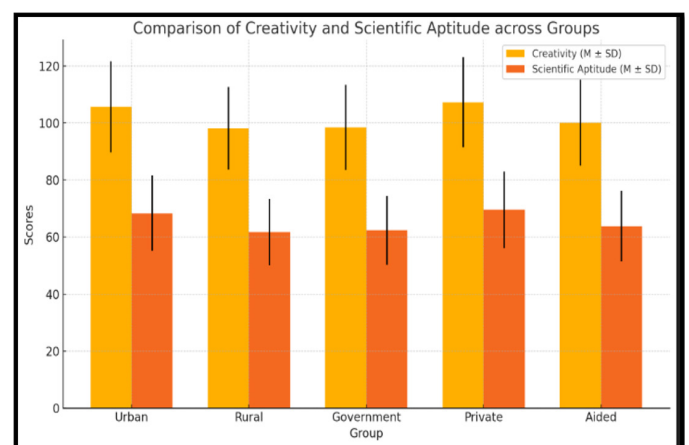
Further examinations were conducted to get a deeper understanding of the complexities of the relationship between creativity and scientific proficiency. An independent samples t-test was used to compare the judgements of creative and scientific aptitude between pupils living in urban and rural settings. The results revealed significant differences in creativity ($t(498) = 5.43, p < 0.001$, Cohen's $d = 0.49$) and scientific aptitude ($t(498) = 6.12, p < 0.001$, Cohen's $d = 0.55$) scores, with urban students demonstrating higher performance

than their rural peers in both domains. The effect sizes suggest that these variations have a rather small degree of practical significance.

A study using analysis of variance (ANOVA) to examine the differences in assessments of creative and scientific ability across different categories of schools, such as government, private, and aided schools. The research found significant differences in creativity ($F(2, 497) = 15.67, p < 0.001, \eta^2 = 0.059$) and scientific aptitude ($F(2, 497) = 18.23, p < 0.001, \eta^2 = 0.068$) scores across various types of schools. The post-hoc Tukey HSD tests revealed a significant difference in creativity and scientific ability between pupils attending private schools and those from government and aided schools ($p < 0.001$ for all comparisons). No significant differences were seen between government and aided schools, as indicated by a p-value larger than 0.05. The effect sizes (η^2) indicate that school type accounts for around 6-7% of the variability in creative and scientific aptitude tests. This suggests that these discrepancies have a moderate degree of practical significance.

Analysis	Group	N	Creativity (M $\pm$ SD)	Scientific Aptitude (M $\pm$ SD)	Test Statistic	p-value
T-test	Urban	280	105.67 $\pm$ 16.01	68.34 $\pm$ 13.22	$t = 5.43$ (Creativity)	<0.001
	Rural	220	98.12 $\pm$ 14.45	61.71 $\pm$ 11.56	$t = 6.12$ (Sci. Apt.)	<0.001
ANOVA	Government	200	98.45 $\pm$ 14.89	62.34 $\pm$ 12.01	$F = 15.67$ (Creativity)	<0.001
	Private	180	107.23 $\pm$ 15.78	69.56 $\pm$ 13.45	$F = 18.23$ (Sci. Apt.)	<0.001
	Aided	120	100.12 $\pm$ 15.12	63.78 $\pm$ 12.34		

Table 4: Additional Analyses Results



DISCUSSION

Interpretation of Findings

The study's findings provide convincing evidence of a substantial and favourable correlation between creativity and scientific ability among high school students in Darbhanga, Bihar. The correlation value ($r = 0.48$) indicates a modest positive association between creativity and scientific aptitude scores. Students with greater levels of creative thinking are more likely to get better results in scientific pursuits. This discovery is consistent with the idea that cognitive attributes

related to creativity, such as thinking outside the box and the ability to adapt, are essential for addressing scientific problems and fostering innovation. The regression analysis provides more evidence that supports this correlation, demonstrating that creativity is the primary determinant in predicting scientific ability, even when accounting for demographic variables. This highlights the potential significance of promoting creativity in science education to improve students' scientific accomplishment and comprehension (Differences in creativity across Art and STEM students: We are more alike than unlike, 2023).

The supplementary investigation uncovers significant contextual elements that impact both creativity and scientific aptitude. The notable disparities seen between urban and rural children, whereby urban pupils get preferential treatment, underscore the possible influence of environmental variables such as resource accessibility, exposure to varied experiences, and the quality of educational facilities (Sumida & Kawata, 2021). Similarly, the discrepancies seen across different kinds of schools, where kids in private schools have greater achievements compared to those in government and aided schools, indicate possible gaps in educational standards and opportunities. These results indicate that creativity is a reliable indicator of scientific ability, although socio-economic and educational variables significantly influence the development of students' creative and scientific talents. This emphasises the need for focused interventions and policies to tackle these inequalities and provide fair opportunity for all children to develop their creative and scientific abilities (Alexopoulos et al., 2021).

Implications for Educational Practices in Darbhanga, Bihar

The research has shown a robust correlation between creativity and scientific competence, which has important implications for science education in Darbhanga, Bihar. It is advisable for educators and policymakers to include activities that enhance creativity within the scientific curriculum. This may include integrating open-ended problem-solving assignments, fostering diverse thinking, and offering chances for students to participate in hands-on, inquiry-based education. Science educators in Darbhanga should get training to cultivate a classroom atmosphere that appreciates and fosters innovative thinking in addition to conventional scientific approaches. This strategy has the potential to enhance students' comprehension of scientific topics and enhance their capacity to apply scientific knowledge in unfamiliar scenarios (Oliveira & Lathrop, 2022).

The evident discrepancies among children residing in urban and rural areas, as well as among students attending various kinds of schools, need specific initiatives to close these inequalities. The educational authorities in Darbhanga should prioritise enhancing resources and facilities in rural schools, with a specific emphasis on scientific labs, libraries, and technological accessibility. It is essential to make endeavours to provide rural kids with a broader spectrum of scientific experiences, maybe by means of field excursions, science fairs, or visiting expert programs. In order to address the inferior performance in creativity and scientific aptitude shown by government and aided schools, it is necessary to evaluate and possibly modify

teaching methodology, teacher training programs, and resource allocation. This is essential to ensure that these schools are on par with private schools (Harold & Lyon, 2023).

Ultimately, the results of the research indicate that a uniform method of teaching science may not provide positive outcomes in Darbhanga. However, a more intricate and situation-dependent approach is required. This may include creating customised educational resources that address the diverse requirements and backgrounds of pupils from various socio-economic circumstances (Kattel & Koirala, 2022). Furthermore, it is important to foster extracurricular activities that cultivate both creativity and scientific reasoning, such as science clubs, innovation challenges, or interdisciplinary projects that integrate science and arts. These activities should be actively promoted in all educational institutions. Partnerships between schools, namely those that are high-performing and failing, have the potential to enhance the sharing of information and exchange of best practices. By applying these modifications, the education system in Darbhanga might strive to cultivate a novel cohort of students who possess not just scientific literacy but also the ability to creatively solve problems, so enhancing their preparedness to tackle future issues (Sharma & Tilak, 2023).

Suggestions for Future Research

This study offers significant findings about the correlation between creativity and scientific ability among high school students in Darbhanga, Bihar. However, it emphasises the need for more research in this field. Longitudinal studies that follow kids from early secondary school to upper secondary school may provide a more thorough insight into the evolving connection between creativity and scientific ability. This study has the ability to determine important time periods for adopting actions and provide insight into the causal processes that explain this relationship. Moreover, it is recommended that future research investigates the effects of targeted therapies aimed at improving creativity on scientific ability. Utilising experimental or quasi-experimental approaches is a method to establish a more certain cause-and-effect relationship (Bezerra et al., 2022).

Future study might include investigating domain-specific creativity within scientific areas. Although this research used a general measure of innovation, examining the expression of creativity in particular scientific fields, such as physics, chemistry, and biology, might provide more detailed and precise findings (Lubart et al., 2022). This may include creating and verifying unique assessments that are tailored to certain fields, particularly in the domain of scientific education, as a component of Bihar's curriculum. In addition, employing qualitative research methods, such as conducting in-depth interviews with exceptional students and their instructors, could provide valuable insights into the strategies and cognitive processes that connect creative thinking with solving scientific problems in this particular cultural and educational environment (Ridlo et al., 2020).

Subsequent investigations should include a wider range

of contextual variables that might potentially impact the correlation between creativity and scientific competence. This may include analysing the influence of parental education and employment, socioeconomic position, and the availability of extracurricular learning options (Creativity and its relationship with intelligence and reading skills in children: an exploratory study, 2023) (Castillo-Vergara et al., 2018). Furthermore, doing research on teacher characteristics, such as teaching methods, inclination towards promoting creativity, and engagement in professional development, might provide useful insights for improving teacher training programs. Conducting cross-cultural comparative study that compares Darbhanga with other locations in Bihar or other states in India might potentially reveal distinct regional elements that influence the relationship between creativity and scientific ability. Conducting a thorough examination in this sector would enhance our understanding of how to promote creativity and scientific expertise in various educational settings. Consequently, this information will be used to formulate policies and practices in the realm of scientific education that are founded on dependable and validated evidence (Sari et al., 2021).

CONCLUSION

The research has yielded useful insights into the correlation between creativity and scientific ability among high school students in Darbhanga, Bihar. The results demonstrate a strong and positive relationship between creative thinking skills and scientific aptitude, suggesting that promoting creativity might be an effective approach to improve scientific performance. The study emphasises significant discrepancies that arise from the geographical location of schools, whether they are situated in urban or rural settings, as well as the specific kind of school. This underscores the need of implementing focused programs to provide equitable access to education. Although creativity is widely acknowledged as a significant factor in scientific ability, it is important to take into account the impact of environmental and socio-economic conditions. These findings have significant ramifications for educational strategies in Darbhanga, necessitating a comprehensive approach to scientific education that include activities fostering creativity and addressing current inequalities. In order to adequately prepare students for the future, Bihar must give priority to enhancing both creative and scientific cognitive abilities while enhancing its educational system. Additional investigation is required to delve into the causal processes that elucidate this correlation and to devise efficacious approaches for fostering creativity and scientific aptitude in diverse educational settings.

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