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IMPACT OF DIGITAL MEDIA CONTENT IN SCIENCE ON SECONDARY LEVEL STUDENTS' SCIENTIFIC CREATIVITY

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Abstract: The integration of digital tools into school has redefined teaching and learning with a notable impact on science education at the secondary level. The integration of digital media content into science instruction has emerged as a significant pedagogical innovation in contemporary education. The present study examines the impact of digital content based science learning on the scientific creativity of secondary level students. Using an experimental design with pre-test, post-test, and retention measures, the study compares the performance of students exposed to digital media content with those taught through conventional instructional methods. The investigation also sought to determine whether the integration of digital media content into classroom instruction influences students' scientific creativity and whether such influence differs across sex and SES. Measurable improvements were observed within the experimental group across testing phases. The findings indicate that digital media content contributes positively to the development and sustenance of scientific creativity by enhancing engagement, conceptual understanding, and creative scientific expression but has no impact across Sex and SES. The study emphasizes the educational value of structured digital interventions in science learning and highlights their role in promoting higher order thinking skills among adolescents.

Index Terms - Digital media content, Science Education, Scientific Creativity, Secondary school students, Experimental Study, Retention, Socio Economic Status (SES).

Introduction:

Scientific creativity is increasingly recognized as a core outcome of science education. It involves the ability to generate novel ideas, propose alternative explanations, design experiments, and apply scientific principles in innovative ways. In the twenty first century, digital technologies have transformed the educational landscape, offering multimedia simulations, animations, interactive experiments, and virtual laboratories that extend learning beyond traditional classroom boundaries.

Digital media content in science instruction allows learners to visualize abstract concepts, manipulate variables dynamically, and engage in exploratory learning. Such exposure is believed to stimulate divergent thinking and problem solving skills, which are the key components of scientific creativity. While conventional teaching methods often emphasize content transmission, digital media provides experiential and inquiry based learning opportunities. However, empirical evidence regarding its measurable impact on scientific creativity at the secondary level remains an area requiring systematic investigation. The present study addresses this need by examining the influence of digital media content based science instruction on students' scientific creativity through structured experimental procedures.

Rationale for the Study:

The rapid expansion of digital resources in education necessitates evidence based evaluation of their effectiveness. Scientific creativity, as an educational objective, requires learning environments that encourage curiosity, experimentation, and innovation. Traditional classroom instruction, though foundational, may not fully support these dimensions.

Digital media content introduces visual, auditory, and interactive elements that can deepen conceptual understanding and stimulate creative engagement. Even in cases where statistical comparisons between groups appear non-significant, improvements within learners across time phases may reflect meaningful pedagogical influence. Therefore, examining pre-test to post-test progression and retention of scientific creative becomes crucial.

This study is justified by the need to understand whether digital media content can serve not merely as a supplementary tool but as a transformative approach capable of enhancing scientific creativity among secondary school students.

Objectives:

The major objectives of the study were:

1. To assess the level of scientific creativity among experimental and control group students' before intervention.
2. To compare the level of scientific creativity among experimental and control group students after intervention.
3. To compare the level of retention of scientific creativity among experimental and control groups.
4. To analyze the extent to which digital media content contributes in improvement of experimental group's scientific creativity from pre-test to post-test.
5. To analyze the extent to which digital media content contributes in retention of experimental group scientific creativity from post-test to retention test.
6. To examine the main and interaction effect of instructional method and Sex on Scientific Creativity.
7. To examine the main and interaction effect of SES (Socio economic status) and teaching method on Scientific Creativity.
8. To determine whether SES has effect on relationship between Instructional method and Scientific Creativity.

Hypothesis:

The following null hypotheses were formulated for the study:

1. There is no significant difference between the pre-test scientific creativity scores of the experimental and control groups.
2. There is no significant difference in the post-test scientific creativity scores of the experimental and control groups.
3. There is no significant difference in the retention test scores of the experimental and control groups.
4. There is no significant improvement in scientific creativity from pre-test to post-test within the experimental group.
5. There is no significant difference in scientific creativity from post-test to retention test within the experimental group.

6. There exists no statistically significant main and interaction effect between the method of instruction and sex on scientific creativity.
7. There exists no statistically significant difference in Scientific Creativity among Students belonging to different SES.
8. There exists no statistically significant main and interaction effect between Instructional method and SES on Scientific Creativity.

V. Methodology:

The pre-test, post-test, control group experimental research design, to examine the effect of digital media content on secondary level students' scientific creativity was used. Secondary level students constituted the sample and were selected through appropriate sampling procedure. The participants were assigned to an experimental group and a control group in a manner that ensured comparability in terms of prior academic achievement in science, intellectual level, and socio economic status, and strengthening the internal validity of the study.

Scientific creativity was measured using a standardized and validated Verbal test of Scientific Creativity scale developed by Dr. V. P. Sharma and Dr. J. P. Shukla was administered at three distinct stages. The scale was administered before the intervention (pre-test), immediately after the instructional period (post-test), and after a specified interval (retention test). This three phase assessment framework enabled the researcher to establish baseline equivalence, evaluate immediate instructional impact, and determine the sustainability of creative gains over time.

The experimental group received science instruction through systematically organized digital media content designed to enhance conceptual clarity and creative engagement. The instructional materials included multimedia presentations, animations, interactive simulations, and concept based digital modules that facilitated visualization of abstract scientific phenomena and encouraged exploratory and inquiry based learning. These digital resources were deliberately integrated into classroom instruction over a defined period to ensure structured and meaningful exposure. In contrast, the control group was taught the same science content using conventional instructional methods, primarily lecture based teaching supported by textbook explanations and routine classroom interaction. Content coverage remained consistent across both groups, ensuring that the mode of instruction constituted the principal independent variable.

The pre-test established initial equivalence between the groups and provided a baseline for comparison. The post-test measured the immediate impact of the intervention on scientific creativity, while the retention test assessed the durability and persistence of creative development. The data collected across all three phases were analyzed using appropriate statistical techniques to compute measures of central tendency and variability, and to determine the statistical significance of observed differences. Two-way analysis of variance (ANOVA) was carried out to examine the significance of differences and to determine the interaction effect of instructional method and both sex and SES on Scientific Creativity of Students.

Findings:

Table 1:Equating the Control and Experimental Groups

GROUPS		N	Mean	SD	t value	Level of significance
Raven's Progressive Matrices	Control	37	41.35	7.617	1.281	Not Significant
	Experimental	37	39.08	7.624		
Socio Economic Status	Control	37	77.89	14.545	1.189	Not Significant
	Experimental	37	82.24	16.867		
Previous Achievement in Science	Control	37	53.64	6.286	0.298	Not Significant
	Experimental	37	54.10	6.939		

Table 2: Comparison of Pre-Test Scientific Creativity Scores of Experimental and Control Groups

Group	Number of students	Mean	SD	t-value	Significance
Control	37	114.38	55.986	0.246	Not Significant
Experimental	37	117.32	46.497		

Table 3: Comparison of Post-Test Scientific Creativity Scores of Experimental and Control Groups

Group	Number of students	Mean	SD	t-value	Significance
Control	37	137.65	56.645	2.045	0.05
Experimental	37	161.54	42.904		

Table 4: Comparison of Retention Test Scores of Experimental and Control Groups

Group	Number of students	Mean	SD	t-value	Significance
Control	37	122.41	49.789	3.440	0.01
Experimental	37	169.19	44.541		

Table 5: Pre-Test and Post-Test Comparison within Control and Experimental Groups

Group	Comparison	Mean		SD		t-value	Significance
Control	Pre vs Post	114.38	137.65	55.986	56.645	7.248	0.01
Experimental	Pre vs Post	117.32	161.54	46.497	42.904	17.754	0.01

Table 6: Post-Test and Retention Test Comparison within Control and Experimental Groups

Group	Comparison	Mean		SD		t-value	Significance
Control	Post vs Retention	137.65	122.41	56.645	49.789	5.131	0.01
Experimental	Post vs Retention	161.54	160.19	42.904	44.541	0.774	Not Significant

Table 7:Observed Data for scientific Creativity (Sex & Teaching Method)

Sex	Teaching Method	Number of Students	Mean	Standard Deviation
Boys	Traditional	21	141.24	55.918
	Digital	18	150.44	36.847
Girls	Traditional	16	132.94	59.076
	Digital	19	172.05	46.470

Table 8:Two-way ANOVA for Scientific Creativity (Sex & Teaching Method)

Sources of Variation	Sum of Squares	Df	Mean Squares	F- Value	Level of Significance
Sex	811.209	1	811.209	0.321	Not Significant
Teaching Method	10695.829	1	10695.829	4.234	0.05
Sex X Teaching Method	4097.618	1	4097.618	1.622	Not Significant
Error	176836.139	70	2526.231		

Table 9: Observed Data for Scientific Creativity (SES & Teaching Method)

Teaching Method		Traditional method	Digital media content
Low	N	11	13
	Mean	131.55	160.00
	Standard Deviation	65.721	45.124
Moderate	N	14	10
	Mean	140.71	166.10
	Standard Deviation	64.803	49.568
High	N	12	14
	Mean	139.67	159.71
	Standard Deviation	39.468	42.904

Table 10: Two-way ANOVA for Scientific Creativity (SES & Teaching Method)

Sources of Variation	Sum of Squares	Df	Mean Squares	F-Value	Level of Significance
SES	684.524	2	343.762	0.129	Not Significant
Teaching Method	11050.948	1	11050.948	4.154	0.05
SES X Teaching Method	225.847	2	112.923	0.042	Not Significant
Error	180920.008	68	2660.321		

Major findings of the study:

The findings of the investigation offer substantive evidence regarding the contribution of digital media content to the development of scientific creativity among secondary level students. The lack of statistically significant difference between the control and experimental groups at the pre-test stage establishes their initial comparability. This equivalence enhances the internal validity of the study, indicating that any subsequent variations in performance can reasonably be associated with the instructional treatment rather than prior differences between the groups.

The post-test comparison had statistical significance at 0.05 level with t-value 2.045, the experimental group obtained a higher mean score in scientific creativity (161.54) than the control group (137.65), reflecting a positive directional trend in favour of digital media based instruction. More notably, the degree of improvement within the experimental group (t = 17.754) exceeded that of the control group (t = 7.248), suggesting that students exposed to digital media content experienced greater enhancement in Scientific Creative abilities. Observed significant gains from pre-test to post-test, the stronger magnitude of change in the experimental group indicates that digital media content enriched instruction was more effective in accelerating creative development than conventional teaching approaches. The integration of multimedia elements, interactive simulations, and visually dynamic representations likely fostered divergent thinking, analytical reasoning, and conceptual flexibility, key dimensions that supports scientific creativity.

The retention results further deepen this interpretation. The control group exhibited a statistically significant decline between post-test and retention (t = 5.131), whereas the experimental group showed no significant decrease (t = 0.774). This pattern suggests that the gains achieved through digital media content based learning were comparatively stable over time. The sustained performance of the experimental group indicates that digitally mediated instruction may strengthen cognitive consolidation processes, thereby supporting long term retention of creative competencies. In contrast, the observed decline in the control group implies that learning acquired through traditional methods may not have been retained with the same degree of stability.

The two-way ANOVA reveals a statistically significant main effect of teaching method at the 0.05 level (F = 4.234), confirming that the mode of instruction significantly influences students' Scientific Creativity. In contrast, the main effect of sex is not statistically significant (F = 0.321), indicating that boys and girls do not differ significantly in their levels of Scientific Creativity. Moreover, the interaction effect between sex and teaching method is also not significant (F = 1.622), which suggests that the advantage of instruction method supported by digital media content, over the traditional method is consistent for both sex.

The two-way ANOVA on SES reveals a statistically significant main effect of teaching method at the 0.05 level (F = 4.154), confirming that the mode of instruction significantly influences students' Scientific Creativity. In contrast, the main effect of SES is not statistically significant (F = 0.129), indicating that Socio Economic Status do not differ significantly in their levels on Scientific Creativity.

Moreover, the interaction effect between SES and teaching method is also not significant (F = 0.042), which suggests that the advantage of instruction method supported by digital media content, over the traditional method is consistent for Low, Medium and High Socio Economic Status of students.

Digital media content contributes meaningfully to both the enhancement and maintenance of scientific creativity. The stronger within group gains and the durability of performance observed in the experimental group emphasizes the pedagogical value of interactive and technology supported learning environments. Given that scientific creativity is a complex and multidimensional construct, it is plausible that enriched, exploratory, and visually engaging instructional contexts, such as those facilitated by digital media content, provide more conducive conditions for its development.

Educational Implications:

The outcomes of the present investigation hold considerable relevance for the advancement of science education at the secondary level. The evidence suggests that the purposeful and systematic incorporation of digital media content into classroom instruction can serve as a catalyst for nurturing creativity and innovative thinking among learners. When digital resources are thoughtfully aligned with curricular objectives, they can enrich conceptual understanding and create opportunities for exploratory and inquiry driven learning experiences that extend beyond conventional instructional practices.

For curriculum developers and academic planners, the findings underscore the importance of embedding multimedia based instructional materials within science curricula. Resources such as simulations, animations, interactive modules, and visual representations should not be treated as peripheral supplements but as integral components designed to facilitate conceptual clarity and creative engagement. A curriculum that intentionally integrates digital media can better accommodate diverse learning styles while fostering higher order cognitive skills.

The study further highlights the necessity for educational institutions to strengthen digital infrastructure in order to support interactive and technology enhanced science learning environments. Reliable access to digital tools, adequate technological facilities, and sustained technical support are essential prerequisites for effective implementation. Without such foundational support, the pedagogical potential of digital media cannot be fully realized.

Teacher preparation and professional development programs also assume critical importance in this context. Educators must be equipped not only with technical proficiency but also with pedagogical competence to integrate digital media meaningfully into instructional practice. Training initiatives should focus on strategies that leverage multimedia tools to promote scientific inquiry, problem solving, and creative reasoning rather than mere content delivery.

Additionally, the findings suggest a need to broaden assessment frameworks within science education. Evaluation systems should incorporate measures of creativity and innovative thinking alongside traditional indicators of academic achievement. By recognizing and assessing creative competencies, educational systems can better reflect comprehensive learning outcomes and encourage instructional approaches that support holistic intellectual development.

Conclusion:

The findings of the study indicate that digital media content in Science exerts a meaningful and sustained impact on secondary level students' Scientific Creativity. The Experimental group demonstrated stronger pre-test to post-test gains and superior retention stability. The evidence suggests that digital media content learning enhances creative growth tracks and supports long term retention of creative competencies. The result also confirmed that no significant differences are observed between SEX and SES, and no interaction effect is found between both sexes and SES with teaching method, indicating that the effectiveness of digital instruction is consistent across sex and all levels of SES groups. There was an observed effect of teaching Method on both Sex and Students belonging to all levels of Socio economic Status. Therefore, digital media integration in science education represents a pedagogically valuable strategy for fostering Scientific Creativity among secondary school students.

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