Research Paper

Development Of An E-Content Based Instruction for Enhancing Creativity and Achievement in Mathematics Among Secondary School Students

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Abstract
The present study investigates the development and effectiveness of an E-content based instructional approach aimed at enhancing creativity and academic achievement in mathematics among secondary school students. Recognizing the limitations of traditional teaching methods in engaging learners and fostering higher-order thinking skills, this study introduces a technology-integrated pedagogy tailored to improve both creative thinking and mathematical performance. An experimental method was employed with a sample of 80 students from Alappuzha district, Kerala, divided into control and experimental groups. The experimental group received instruction through the developed E-content modules, while the control group followed conventional activity-oriented methods. Pre-tests and post-tests were conducted using tools developed by the researcher to measure creativity and achievement. Data were analysed using descriptive statistics, paired t-tests, and ANCOVA. Findings revealed that E-content based instruction significantly enhanced both creativity and mathematical achievement compared to traditional methods. The study highlights the potential of digital pedagogy in transforming mathematics education and calls for broader implementation in contemporary classrooms.

I. INTRODUCTION

In recent years, the integration of digital technology into education has revolutionized teaching and learning across disciplines. As we move deeper into the 21st century, educators are increasingly exploring digital tools to enhance the effectiveness of instruction, particularly in subjects that traditionally pose challenges to students, such as mathematics. Mathematics, often perceived as abstract and difficult, demands higher-order thinking, creativity, and problem-solving abilities—skills that are crucial not just for academic success but also for real-life applications and career readiness.

Creativity plays a vital role in mathematics by encouraging students to think divergently, explore multiple solutions, and apply knowledge in novel ways. However, conventional classroom practices often rely heavily on rote memorization, formulaic problem-solving, and rigid instructional formats that limit creative exploration. In such environments, students may achieve procedural proficiency but struggle with conceptual understanding and innovation.

To address these concerns, educators are increasingly turning toward **E-content based instruction**, which utilizes digital media such as videos, animations, simulations, interactive quizzes, and gamified learning modules. E-content has the potential to create a more dynamic, personalized, and engaging classroom experience. When thoughtfully implemented, it can accommodate diverse learning styles, promote active participation, and foster both academic achievement and creative expression.

This study was undertaken with the intention of developing an E-content based instructional strategy and empirically testing its effectiveness in improving creativity and achievement in mathematics among secondary school students. By using an experimental design involving control and experimental groups, the

study systematically evaluates the pedagogical value of E-content instruction compared to traditional activity-based teaching.

HYPOTHESES OF THE STUDY
The following hypotheses were formulated for the present study.
1. There is no significant difference between E- content based group and activity method group in Pre-test scores of Creativity.
2. There is no significant difference between E-content based group and activity method group in Pre-test scores of Achievement in Mathematics.
3. There is no significant difference between experimental group and control group in their post-test scores after they have been adjusted for difference in the pre - test scores of Creativity.
4. There is no significant difference between experimental group and control group in their post-test scores after they have been adjusted for difference in the pre - test scores of Achievement in Mathematics.
5. There is no significant difference between E- content based group and activity method group in gain scores of Creativity.
6. There is no significant difference between E-content based group and activity method group in gain scores of Achievement in Mathematics.

OBJECTIVES OF THE STUDY
The study has been designed with the following objectives.
1. To find out the level of Creativity of secondary school students.
2. TotestwhetherE-contentBasedInstructioniseffectiveinenhancingCreativity of secondary school students.
3. To test whether E-content Based Instruction is effective in enhancing Achievement test in Mathematics of secondary school students.
4. To test whether E-content Based Instruction is more effective than activity- oriented method in enhancing Creativity of secondary school students.
5. To test whether E-content Based Instruction is more effective than activity- oriented method in enhancing Achievement test in Mathematics of secondary school students.

II.   METHODOLOGY

The study adopted an experimental research design to examine the effectiveness of E-content based instruction on creativity and mathematics achievement among secondary school students. A sample of 80 students from K.V. Sanskrit H.S.S, Muthukulam, was randomly divided into an experimental group and a control group, each with 40 students. The experimental group was taught using a specially developed E-content package, while the control group followed the conventional activity-oriented method. Pre-tests and post-tests were administered using researcher-developed tools to assess creativity and achievement. Data were analysed using descriptive statistics, paired t-tests, and ANCOVA with the help of EDUSTAT software.

III.   Result

Table1
Test of significance of difference between means of Pre-test scores of Creativity of E- content based group and activity method group

Group	Number	Mean	Standard deviation	Level of significance	
				t	
E Content BasedGroup	40	10.3	1.29		
Activity Method Group				1.23	Not significant
	40	9.93	1.44		

The calculated value of t is 1.23 and is not significant at 0.05 level (t = 1.23; p>0.05).Sincethemean ofthe E-contentbasedgroupdonotdiffersignificantlyfrom that of the activity method group, E- content based group and activity method group are more or less equal in pre-test scores of Creativity.

Tenability of Hypothesis
Testofsignificanceofdifferencebetweenmeansofpre-testscoresofCreativity   ofE-contentbasedgroupandactivitymethodgrouprevealedthatthereisnosignificant   differencebetweenE-contentbasedgroupandactivitymethodgroupinpre-testscores of Creativity. Hence the null hypothesis formulated in this context is not rejected.

Testing of Hypothesis2

Table2

Test of significance of difference between means of Pre-test scores of Achievement in Mathematics of E-content based group and activity method group.

Group	Number	Mean	Standard deviation	Level of significance t	
E Content BasedGroup	40	10.65	1.76		
Activity Method Group				0.58	Not significant
	40	10.88	1.68		

The calculated value of t is 0.58 and is not significant at 0.05 level (t = 0.58; p>0.05).Sincethemean ofthe E-contentbasedgroupdonotdiffersignificantlyfrom   thatoftheactivitymethodgroup,E-contentbasedgroupandactivitymethodgroupare more or less equal in pre-test scores ofAchievement in Mathematics.

Tenability of Hypothesis

Test of significance of difference between means of Pre-test scores of Achievement in Mathematics of E-content based group and activity method group revealed that there is no significant difference between E-content based group and activity method group in Pre-test scores of achievement. Hence the null hypothesis formulated in this context is not rejected.

Testing of Hypothesis 3

Table 3

AnalysisofCovarianceofpre-testandpost-testscoresofexperimentalgroupand control group

Source of variation	df	Sum of squares	Mean square	F	Level of significance
Among means	1	3420.93	3420.93		
Withingroups	77	402.25	5.22	654.84	0.01
Total	78	3823.18			

The obtained value of F is 654.84 and is significant at 0.01 level. (F = 654.84; p<0.01). This shows that the post-test mean scores of treatment groups differ significantly after they have been adjusted for difference in the pre-test scores of creativity.

Table 4

Pre-test,post-testandadjustedpost-testmeanscoresofthetreatmentgroups

Group	Numberof students	Meanofpre-test scores	Meanofpost- test scores	Adjusted post-testmeanscores
Control	40	9.93	10.83	10.86
Experimental	40	10.3	24.1	24.06

Thesignificantdifferencebetweentheadjustedpost-testmeansofindicatesthat thepupilsofexperimentalandcontrolgroupdiffersignificantlyintheirpost-testscores after they have been adjusted for difference in the pre-test scores of Creativity. Since theadjustedmeanofpost-testscoresofexperimentalgroupissignificantlygreaterthan thatofthecontrolgroup,thetreatmentappliedtotheexperimentalgroupisbetterthan that applied to the control group.

Tenability of Hypothesis

Analysis of Covariance of pre-test and post-test scores of experimental group and control group revealed that there is significant difference between control group and experimental group in their post-test scores after they have been adjusted for difference in the pre-test scores of Creativity. Hencethe null hypothesis formulated in this context is rejected.

Testing of Hypothesis 4

Table 5

AnalysisofCovarianceofpre-testandpost-testscoresofexperimentalgroupand control group

Source of variation	df	Sum of squares	Mean square	F	Level of significance
Among means	1	960.45	960.45		
				185.06	0.01
Within groups	77	399.63	5.19		
Total	78	1360.09			

The obtained value of F is 185.06 and is significant at 0.01 level. (F = 185.06; p<0.01). This shows that the post-test mean scores of treatment groups differ significantly after they have been adjusted for difference in the pre-test scores of Achievement in Mathematics.

Table6

Pre-test,post-testandadjustedpost-testmeanscoresofthetreatmentgroups

Group	Number of students	Meanofpre- test scores	Meanofpost- test scores	Adjustedpost- testmeanscores
Control	40	10.88	16.98	16.98
Experimental	40	10.65	23.93	23.92

The significant difference between the adjusted post-test means of indicates that the pupils of experimental and control group differ significantly in their post-test scoresaftertheyhavebeenadjustedfordifferenceinthepre-testscoresofAchievement in Mathematics. Since the adjusted mean of post-test scores of experimental group is significantly greater than that of the control group, the treatment applied to the experimental group is better than that applied to the control group.

Tenability of Hypothesis

Analysis of Covariance of pre-test and post-test scores of experimental group and control group revealed that there is significant difference between control group and experimental group in their post-test scores after they have been adjusted for difference in the pre-test scores of Achievement in Mathematics. Hence the null hypothesis formulated in this context is rejected.

Testing of Hypothesis 5

Table7

TestofsignificanceofdifferencebetweenmeansofgainscoresofCreativityofE- content based group and activity method group

Group	Number	Mean	Standard deviation	t	Level of significance
EContentBased Group	40	7.7	3.69		
				9.85	0.01
Activity MethodGroup	40	1.73	1.04		

The calculated value of t is 9.85 and is significant at 0.01 level (t = 9.85; p<0.01).SincethemeanoftheE-contentbasedgroupissignificantlygreaterthanthat of the activity method group, E- content based group have more gain scores of Creativity than activity method group.

Tenability of Hypothesis

TestofsignificanceofdifferencebetweenmeansofgainscoresofCreativityof E- content based group and activity method group revealed that there is significant differencebetweenE-contentbasedgroupandactivitymethodgroupingainscoresof Creativity. Hence the null hypothesis formulated in this context is rejected.

Testing of Hypothesis 6

Table8

TestofsignificanceofdifferencebetweenmeansofgainscoresofAchievementin Mathematics of the E-content-based group and the activity method group

Group	Number	Mean	Standard deviation	t	Level of significance
E Content BasedGroup	40	13.28	2.98		
				11.19	0.01
Activity MethodGroup	40	6.1	2.75		

The calculated value of t is 11.19 and is significant at 0.01 level (t = 11.19; p<0.01).SincethemeanoftheE-contentbasedgroupissignificantlygreaterthanthat of the activity method group, E-content based group have more gain scores of Achievement in Mathematics than activity method group.

Tenability of Hypothesis
Test of significance of difference between means of gains cores of Achievement in MathematicsofE-contentbasedgroupandactivitymethodgrouprevealedthatthere is significant difference between e content based group and activity method group in gain scores of Achievement in Mathematics. Hence the null hypothesis formulated in this context is rejected.

IV.   DISCUSSIONAND CONCLUSION

The present study confirms that E-content based instruction is a powerful pedagogical tool for enhancing both creativity and academic achievement in mathematics among secondary school students. The experimental group, which received digital instruction, demonstrated statistically significant improvements in creativity and mathematical performance compared to their peers taught through conventional activity-oriented methods. These findings are consistent with earlier research by Wang et al. (2021) and Singh et al. (2020), who observed that E-content improves students' creative thinking abilities and promotes innovative problem-solving skills. Similarly, studies by Li and Ma (2021) and Clark and Mayer (2019) support the conclusion that multimedia-rich and adaptive learning environments significantly enhance mathematical understanding and achievement.

The interactive nature of E-content, along with personalized feedback and visual aids, provides a learning experience that caters to various cognitive styles, increasing student engagement and motivation. This study's results also align with Dede and Richards (2021), who emphasized the motivational impact of digital learning platforms in maintaining student interest and improving learning outcomes.

Though limited by sample size and geographic scope, the study offers empirical evidence supporting the integration of technology in education. It advocates for curriculum reform to include well-designed E-content resources as a means of fostering not just academic success, but also higher-order cognitive skills such as creativity, critical thinking, and independent learning. Future research could explore the long-term effects of E-content in different subjects and demographic contexts to further validate its effectiveness and scalability in diverse educational settings.

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