ISSN: 3048-9423(Online)
Naveen International Journal of Multidisciplinary Sciences (NIJMS)
© NIJMS | Vol. 1 | Issue 3 | December-January 2025
Available online at: https://nijms.com/
DOI: https://doi.org/10.71126/nijms.v1i3.29

EFFECTIVENESS OF ICT INTEGRATED PEDAGOGY FOR MATHEMATICS IN TERMS OF PROBLEM SOLVING ABILITY OF CLASS IX STUDENTS OF MADHYA PRADESH

Sanjay Kushwah [1] and Prof. Ratnamala Arya [2]

[1] *UGC-JRF, Department of Education, Regional Institute of Education (RIE), NCERT, Bhopal, MP, India*

[2] *Professor, Department of Education, Regional Institute of Education (RIE), NCERT, Bhopal, MP, India*

[1]***Corresponding Author Email:*** *kushwahsanjay89@gmail.com*

[2]***Email:*** *ratnamalaarya@gmail.com*

ABSTRACT:

Humanity's unique position as the pinnacle of nature, driven by innate curiosity and creativity. This drive has fuelled continuous learning and led to significant technological advancements, transforming society and the global economy. Specifically, impact of Information and Communication Technology (ICT) across various sectors, particularly education, where it empowers learners, teachers, and administrators. This study investigates the effectiveness of ICT integrated pedagogy on problem solving ability for ninth-grade students in Madhya Pradesh. A true experimental pre-test post-test control group design was employed at GHS, Nayakheda, Datia, involving 92 students. Purposive and simple random sampling was used for school and treatment group selection, respectively. The findings highlight key features of effective ICT integration within mathematics instruction in the region.

Keywords: *ICT integrated pedagogy, Problem Solving Ability, Pedagogy of mathematics.*

1. INTRODUCTION

In today's dynamic educational landscape, schools are tasked with equipping students not just with knowledge, but with the critical problem-solving abilities necessary to thrive in a complex, technology-driven world. Research consistently highlights the power of computer technology, particularly Information and Communication Technology (ICT), in fostering higher-order thinking skills like critical analysis, scientific inquiry, and, crucially, effective problem-solving.

The imperative is clear: we must move beyond rote learning and embrace a pedagogy that cultivates "Learning to Learn"—the capacity for continuous knowledge acquisition and skill development. This is

particularly vital in mathematics, a discipline increasingly recognized for its foundational role in technology and industry. While traditionally viewed as abstract and challenging, mathematics provides an ideal platform for developing structured problem-solving approaches. However, the perception of mathematics as a tedious subject often hinders student engagement, posing a significant pedagogical challenge, especially at foundational levels where robust conceptual understanding is paramount.

This is where **ICT-integrated pedagogy emerges as a transformative solution**. By leveraging digital tools and resources, educators can create engaging and interactive learning experiences that shift the focus from passive information absorption to active problem-solving. ICT can provide:

- **Visualizations and simulations:** To demystify complex mathematical concepts and make abstract ideas tangible, aiding in problem comprehension.
- **Interactive problem-solving platforms:** To offer students opportunities to practice applying mathematical principles in diverse, real-world scenarios, fostering analytical and logical reasoning.
- **Data analysis tools:** To empower students to explore patterns, draw conclusions, and develop data-driven problem-solving strategies.
- **Collaborative online environments:** To facilitate peer learning and the sharing of problem-solving approaches, promoting diverse perspectives and collaborative problem-solving skills.

By strategically integrating ICT into mathematics education, we can cultivate a learning environment that not only enhances conceptual understanding but also empowers students to become confident and proficient problem solvers. This study, therefore, investigates how ICT-integrated pedagogy can be effectively utilized to enhance mathematics learning, specifically focusing on the development of critical thinking and problem-solving skills essential for navigating the challenges of the 21st century."

2. RATIONALE OF THE STUDY:

The educational landscape is undergoing a profound transformation driven by the proliferation of digital technologies . This digital age necessitates a re-evaluation of pedagogical approaches, placing Information and Communication Technology (ICT) at the forefront. As highlighted by India's New Education Policy 2020 (NEP 2020), ICT is not merely a supplementary tool but a critical instrument for bridging the gap between pedagogical practices, research, and policy. The NEP 2020 emphasizes the role of technology in enhancing access, quality, and equity in education, recognizing its potential to empower both teachers and learners (National Education Policy 2020). Specifically within mathematics education, the integration of ICT holds immense potential for improving learning outcomes, particularly in the development of problem-solving abilities. Therefore, this study aims to develop and evaluate an ICT-integrated learning pedagogy specifically designed for ninth-grade mathematics. By focusing on the development and evaluation of a specific ICT-integrated pedagogy, this study seeks to contribute to the growing body of knowledge on how to effectively leverage technology to improve problem solving ability and cultivate essential 21st-century skills, in line with the goals of the NEP 2020.

3. OBJECTIVES:

The objectives were formulated for the study are as follows:

i. To study the effectiveness of ICT Integrated Pedagogy for Mathematics in terms of Problem Solving Ability.

ii. To study the effect of Treatment, Gender and their Interaction on Problem Solving Ability by taking their pre-test scores of Problem Solving Ability as covariate.

4. HYPOTHESIS:

Using pre-test problem-solving ability scores as covariates, the following null hypotheses were examined:

i. There is no significant effect of treatment on students' problem-solving ability.

ii. There is no significant effect of gender on students' problem-solving ability.

iii. There is no significant interaction between treatment and gender on students' problem-solving ability.

5. METHODOLOGY

The present study falls under the experimental category. A true-experimental pre-test post-test equivalent **control group design** is employed. One group, designated as the experimental group, is exposed to ICT-integrated pedagogy for mathematics teaching. The other group, the control group, is exposed to the traditional approach of teaching mathematics.

In this study, a **simple random** sampling technique was used for sample selection. The research involved **92 students** from class IX of Govt. High School, Nayakheda, Datia, Madhya Pradesh. The sample was evenly divided, with 46 students in the **experimental group** and 46 students in the **control group.**

A **Problem Solving Ability Test** was developed by the **L. N. Dubey** to assess the effect of ICT-integrated pedagogy and the traditional approach on the problem solving ability of class IX students.

This experimental study compared ICT-integrated pedagogy with traditional teaching methods in mathematics. Students were randomly assigned to either the experimental (ICT) group or the control (traditional) group. Both groups were administered a pre-test and a post-test using the Problem Solving Ability Test. The experimental group received instruction using ICT integrated pedagogy approach, while the control group received traditional instruction on the same mathematical concepts. Post-test scores were then compared to evaluate the effectiveness of each teaching method.

6. ANALYSIS AND INTERPRETATION OF THE RESULT:

Effectiveness of ICT Integrated Pedagogy in terms of Problem Solving Ability of the students

Table - Post-test Problem Solving Ability Scores of Experimental Group

Experimental Group		Statistic	Std. Error
	N	46	
	Mean	11.42	.223
	Variance	3.248	
	Std. Deviation	1.724	
	Minimum	9	
	Maximum	16	
	Range	7	
	Skewness	1.127	.319
	Kurtosis	.495	.628
Percentiles	5	7	
	10	9	
	25	10	
	50	11	
	75	12	
	90	15	
	95	15.50	

Table 6.1 (The results related to each of these are presented)

The data in Table 6.1 highlights the effectiveness of ICT-integrated pedagogy in improving Problem Solving Ability. The experimental group demonstrated a mean score of 11.42, with a SD of 1.724 and a coefficient of variation of 3.248. The score distribution is particularly noteworthy: over 50% of student's surpassed 11 marks, 25% exceeded 12, 10% scored above 15, and 5% achieved over 15.50. Crucially, only 5% scored below 7. This skew towards higher scores, uncommon with traditional methods, strongly suggests that ICT integration significantly benefits students' problem-solving abilities.

EFFECT OF TREATMENT, GENDER AND THEIR INTERACTION ON PROBLEM SOLVING ABILITY:

This research aimed to determine how different teaching approaches (ICT-integrated pedagogy and traditional) and gender affect students' problem-solving abilities. To do this, researchers used a 2x2 factorial ANCOVA, with pre-test problem-solving scores as a covariate, to control for initial differences. They analyzed how the teaching method, gender, and their interaction influenced post-treatment problem-solving abilities, with results detailed in Tables 6.2 and 6.3.

Summary of 2X2 Factorial Design ANCOVA for Problem Solving Ability of Students by taking their Pre-test Score of Problem Solving Ability as Covariate

Sources of Variance	df	SSy.x	MSSy.x	F-Values
Group	1	27.43	27.43	37.94**
Gender	1	0.19	0.19	0.28
Group X Gender	1	0.22	0.22	0.31
Error	87	72.33	0.69	
Total	90	100.17		

Table - 6.2 ***significant at 0.01 level*

Mean, SD for Students Problem Solving Ability

Group	Gender	Mean	Std. Deviation	N
Control Group	Female	10.11	1.887	22
	Male	10.19	1.304	24
	Total	**10.15**	**1.558**	**46**
Experimental Group	Female	11.32	1.473	22
	Male	11.52	1.97	24
	Total	**11.42**	**1.724**	**46**
Total	Female	10.71	1.633	46
	Male	10.85	1.908	46
	Total	**10.74**	**1.776**	**92**

Table - 6.3

Effect of Treatment on Problem Solving Ability

Table 6.2 reveals a statistically significant effect of the treatment on problem-solving ability. F-value of 37.94 (df 1/90, $p < 0.01$) indicates a significant difference in adjusted mean scores between the treatment and control groups, even after controlling for pre-test scores of problem solving ability. Consequently, the null hypothesis, which stated no significant treatment effect, is rejected. This demonstrates that the ICT-integrated pedagogy significantly affect students' problem-solving abilities, independent of their initial skill levels.

Furthermore, Table 6.3 provides descriptive statistics. Students taught using the ICT integrated pedagogy exhibited a higher mean problem solving ability score (11.42, SD = 1.724) compared to those taught with the traditional method (10.15, SD = 1.558). This difference in means confirms the effectiveness of the ICT integrated pedagogy. The slightly higher standard deviation in the treatment group suggests greater variability in scores, but the higher mean indicates that the ICT integrated pedagogy was effective in improving the overall problem solving ability of the students, when compared to the traditional method.

Effect of Gender on Problem Solving Ability

Table 6.2 reveals a statistically not significant effect of the gender on problem-solving ability. F-value of 0.28 (df 1/90, $p < 0.05$) indicates a not significant difference in adjusted mean scores between the boys and girls, even after controlling for pre-test scores of problem solving ability. Consequently, the null hypothesis, which stated no significant gender effect, is not rejected. This demonstrates that the gender not significantly affect students' problem-solving abilities, independent of their initial skill levels.

Furthermore, Table 6.3 provides descriptive statistics that the boys students exhibited a slightly higher mean problem solving ability score (10.85) compared to girls (10.71). However, the problem-solving ability scores of girls are more homogeneous, as shown by a lower standard deviation (SD = 1.633) compared to boys (SD = 1.908).

Interaction of Treatment and Gender on Problem Solving Ability

Table 6.2 reveals a statistically not significant effect of the treatment and gender on problem-solving ability. F-value of 0.31 (df 1/90, $p < 0.05$) indicates a not significant difference in interaction between the treatment and gender, even after controlling for pre-test scores of problem solving ability. Consequently, the null hypothesis, which stated no significant treatment and gender effect, is not rejected. This demonstrates that

the interaction between treatment and gender not significantly affect students' problem-solving abilities, independent of their initial skill levels.

Table 6.3 presents the mean problem-solving scores for both experimental and control groups, separated by gender. In the experimental group, boys exhibited a slightly higher mean score (11.52) compared to girls (11.32), with greater variability among boys (SD=1.97) than girls (SD=1.473). Conversely, in the control group, girls demonstrated a marginally higher mean score (10.11 vs. 10.19 for boys), with greater variability observed among girls (SD=1.887) than boys (SD=1.304).

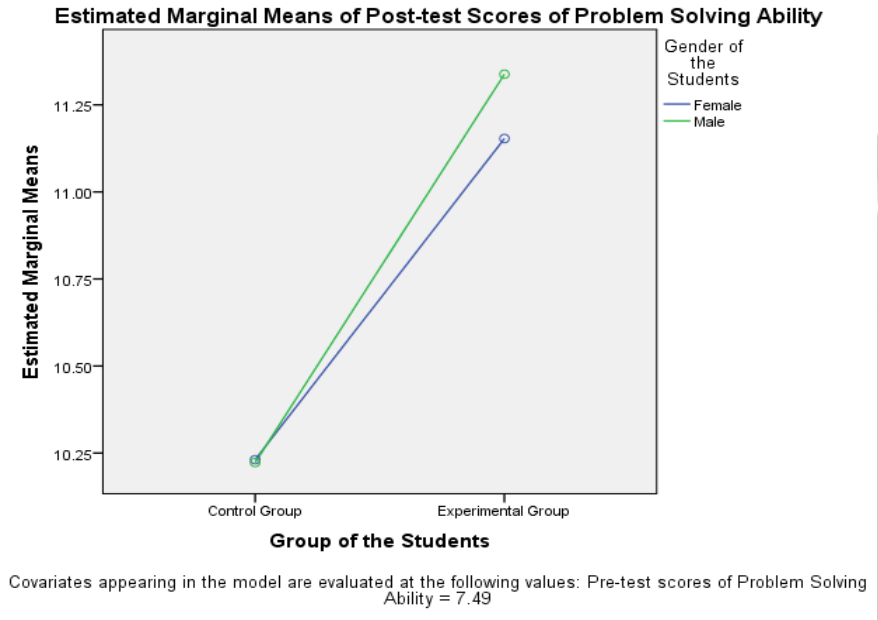

Fig.: Interaction of Treatment and Gender on Problem Solving Ability

7. FINDINGS OF THE STUDY

1. There is a significant effect of Treatment on problem solving ability of the student when their pre-test scores of problem solving ability are taken as covariate.

2. There is no significant effect of gender on problem solving ability of students when their pre-test scores of problem solving ability are taken as covariate.

3. There is no significant Interaction of Treatment and Gender on the problem solving ability of the students when their pre-test scores of problem solving ability are taken as covariate.

8. CONCLUSION

This study provides conclusive evidence that ICT-integrated pedagogical approaches significantly outperform traditional teaching methods in fostering students' problem-solving abilities. Furthermore, the analysis revealed that gender did not significantly influence student performance when pre-test scores were controlled as covariates, and no significant interaction effect was observed between treatment and gender. This suggests that the benefits of ICT integration are consistent across gender groups. Therefore, the implementation of ICT-enhanced learning environments represents a valuable and equitable strategy for enhancing student problem-solving and related cognitive skills.

REFERENCES

[1] E N Herdianto *et al* (2020) ICT-Based Learning Media to Enhance Students' Problem Solving Ability in Efforts to Face the Industrial Revolution 4.0. *J. Phys.: Conf. Ser.* http://dx.doi.org/10.1088/1742-6596/1511/1/012097

[2] Hutapea, Tri & Sinambela, Pardomuan & Adlin, Dilinar. (2020). Ability of Problem Solving Students Based on Information and Communication Technology. Journal of Physics: Conference Series. http://dx.doi.org/10.1088/1742-6596/1485/1/012052

[3] Jager, A. K. and Lokman A. H. (1999) : "Impacts of ICT in education. The role of the teacher and teacher training", Paper presented at the European Conference on Educational Research, Lahti, Finland 22-25 September, 1999

[4] Lawal O.W, Loyinmi A. C. and Abolarinwa A. (2013) Information and Communication Technology (ICT) Supported Mathematics Instruction for Students with Disabilities. Journal of Education and Practice. ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.4, No.8, 2013.

[5] Majumdar, S. 2004. Integrating ICT in Teaching & Learning: A Functional Approach Presented at the UNESCO-APEID Writing Workshop for a Guideline and Competency Based Standards for Teachers' PedagogyTechnology Integration, Hua Hin, Thailand. March 28-31.

[6] Resnick, L. B., & Science National Research Council (US). Committee on Research in Mathematics. (1987). *Education and learning to think.* National Academy Press, Washington

[7] Sutherland, R., Robertson, S., & John, P. (2004). *Interactive education: teaching and learning in the information age.* Journal of Computer Assisted Learning, 20(6), 410-412. https://doi.org/10.1111/j.1365-2729.2004.00100.x

[8] Sarkar, Satyajit. (2021). IMPACT OF PROBLEM SOLVING SKILLS TO ACHIEVE IN MATHEMATICAL ABILITY OF THE FEMALE STUDENTS OF SECONDARY LEVEL OF EDUCATION. DOI: 10.17148/IARJSET.2021.8828

[9] Delima, N. (2017). *A relationship between problem solving ability and students' mathematical thinking*. *Infinity Journal*, *6*(1), 22-28. http://dx.doi.org/10.22460/infinity.v6i1.231

[10] UNESCO. 2005. Regional Guidelines on Teacher Development for Pedagogy-Technology Integration [Working Draft] (Ed S. Majumdar). UNESCO, Bangkok.

Cite this Article:

***Sanjay Kushwah and Prof. Ratnamala Arya**, "**EFFECTIVENESS OF ICT INTEGRATED PEDAGOGY FOR MATHEMATICS IN TERMS OF PROBLEM SOLVING ABILITY OF CLASS IX STUDENTS OF MADHYA PRADESH**", Naveen International Journal of Multidisciplinary Sciences (NIJMS), ISSN: 3048-9423 (Online), Volume 1, Issue3, pp. 103-109, December-January 2025.*

Journal URL: https://nijms.com/

DOI: https://doi.org/10.71126/nijms.v1i3.29