Educational Administration: Theory and Practice
2024, 30(6), 4944-4949
ISSN: 2148-2403
https://kuey.net/

Research Article

Nurturing Mathematical Skills Through Community Based Education Programme : An Experimental Study

Dr. Mayur Pujari[1*]

[1*]Assistant Professor, Department of Education, Central University of Karnataka, Kalaburagi-585367

Citation: Dr. Mayur Pujari (2024), Nurturing Mathematical Skills Through Community Based Education Programme : An Experimental Study, *Educational Administration: Theory and Practice, 30(6)* 4944-4949
Doi: 10.53555/kuey.v30i6.8925

ARTICLE INFO

ABSTRACT

The purpose of this study is to investigate the influence of community based education on mathematics learning of elementary school student's. An experimental method was adopted. In all, 2619 students were selected from class III to class VIII through simple random sampling technique. Mathematics Skill Inventory developed by the researcher is used to collect the data. Findings revealed that, the average overall Endline (EL-86%) score is higher than baseline (BL51%) score, with 34.9% gain in Mathematics. The average endline performance for mathematics test ranges from 78% to 92.7% across classes (grade III to VIII) for all the students. Common students have scored in range of 83.4% to 91.3%. Meaningful improvements are observed from BL to EL with differences statistically significant, and large effect sizes.

Key Words: Academic learning, Pandemic, Community learning centers and Animators.

Introduction

Education, particularly at the elementary level, is deemed crucial for every individual in a democratic society. Primary education lays the essential groundwork for enhancing human resources, which are vital for our personal, social, and national growth. The development of the nation depends on both the accessibility and quality of primary education.

"The COVID-19 pandemic had a very negative impact on formal educational activities since March 2020. School were closed and students were away from their traditional classroom learning setup for extended period. A total of 320 million learners in India were adversely affected with the e-learning solution (Khan & Mohakud, 2022). With significant regional and household disparities in access to the internet and technology, this transition was impossible for many students, especially students from disadvantaged, rural backgrounds. The education system in India is facing a new crisis. Besides the anticipated effect on learning outcomes, experts suggest that the extended school closure is likely to result in a loss in human capital and diminished economic opportunities in the long run".

Hence, this study aims to investigate the impact of **community-based education interventions on students' mathematics performance** and to compare the learning achievements in mathematics among elementary students, providing insights into the effectiveness of localized educational approaches

Need and Significance of the Study

Primary schooling is the starting phase of education that lays foundation for a child's learning journey. It is a crucial period where children develop fundamental skills, gain knowledge, and shape their overall growth. In India, primary education is grouped in two parts: lower primary (grades I to V) and higher/upper primary (grades VI to VIII). This education helps students between the ages of 6 and 14, when children begin to seek information, skills, and personal development. In India, for many students, primary education is the gateway to a better life. Children learn fundamental reading, basic mathematical operations, and life skills necessary to escape the cycle of materialism and achieve success in life(UNICEF, 2021).

In Yadgiri district of Karnataka, India, COVID-19 had a direct impact on children's education and well-being, as well as on family health and livelihoods. To mitigate the adverse effects of the pandemic on education, the non-government organizations in addition to governmental agencies during post-pandemic academic year

2021-2022 paid significant attention. (*Learning Loss during Covid-19*, 2021). Schools were closed from mid-March 2020 and reopened only in December 2020. However, the second wave of COVID-19 in Karnataka led to another closure of schools from April 2021 onwards. Parents' fears and anxiety about COVID-19 resulted in a steep decline in student enrolment and attendance, leading to poor learning outcomes during 2021-22. The situation was further exacerbated by the ongoing pandemic, school closures, and loss of livelihoods. While e-learning became the norm in private elite schools and received considerable media attention, it was not a feasible option in this context. When schools reopened, it was anticipated that student attendance would be low, learning levels would deteriorate, and the psychological impact of fear and misinformation would further affect schooling(DemiR et al., 2022).

Considering the ground reality in ensuring continued effectiveness and impact of last six years investment of Kalike-Tata Trusts on primary education in North-East Karnataka for strengthening and ensuring quality education, it was found highly desirable in their practices during the pandemic. The objective was to support the system to respond to the situation more effectively in promoting academic activities through running up community level learning centres for school children, onsite support and community/SDMC engagement to keep the tempo and spirit of school functionaries, parents, and children.

The present study assesses the school students learning facility during pandemic and the impact of alternate mode of learning engagement on students during school closure due to COVID pandemic in Yadgiri district. The findings of the study may help understand the learning achievement of students and design an appropriate remedial input to cope of grade specific learning's. Further, the findings bring an insight to build activities to enhance student's mathematics learning and provide a broader frame in such community level intervention.

Methodology

The present study was designed to understand the influence of community based education programme. The study was conducted in Yadgiri blocks of Yadgiri district in Karnataka state by adopting random sampling technique. Out of 156 villages in Yadgiri block, 50 villages were selected where enrolment of students is higher than 150 in the elementary grades (I-VIII). In these villages, the intervention was implemented by taking consensus of various stakeholders including the parents.

For the Baseline (pre-test) 11 villages and Endline (post-test) 12 villages were selected and tested 1243 and 1376 students in baseline and endline respectively from grade III to VIII. The study employs a quantitative research methodology to examine the impact of communitybased education on mathematics achievement. The independent variable is community-based education, while the dependent variable is students' mathematics achievement. Background variables, including gender and locality, are considered to explore their potential influence on the relationship between the independent and dependent variables.

In analysing students' performance in mathematics, a focused effort was made to evaluate the performance of specific students who participated in both the pre-test and post-test assessments. The performance of these students was analysed separately as common students to provide a comparative understanding of their improvement.

Statistical Techniques

○ *Average Score* **-** An average test score or mean score is calculated by summing up all the scores on an assessment and dividing the total by the number of scores. o *Standard Deviation* **-** Standard Deviation (SD) is one of the basic methods of statistical analysis. It typically shows the deviation (variation/dispersion) from the mean/average. o *Gain (El-BL)* - Gain is difference in the scores of endline and baseline tests.

○ *Cohen's D/Effect size* **-** Cohen's D or standardized mean difference measures the effect size of difference between two groups or means. o *Effect Size* - Effect size is a quantitative measure of the magnitude of the experimental effect. The larger the effect size the stronger the relationship between two variables. The interpretation of effect size is based on Cohen's d values. The value of 0.2 is considered as Small effect = 0.2; the value of 0.5 represents Medium Effect = 0.5 and the value of 0.8 a Large Effect. If the difference between two group's means is less than 0.2, the difference is negligible even if it is statistically significant.

The **Table1** provides gender wise distribution of the number of students tested in the baseline and endline assessment.

Table-1: Total number of students tested

Baseline (Oct 2021)				**Endline (April 2022)**			
Grade	**Girls**	**Boys**	**Total**	**Class**	**Girls**	**Boys**	**Total**
III	131	92	223	III	138	99	237
IV	124	100	224	IV	145	99	244
V	112	100	212	V	117	110	227
VI	125	114	239	VI	147	110	257
VII	143	106	249	VII	147	92	239
VIII	50	46	96	VIII	94	78	172
---	**685**	**558**	**1243**	--	**788**	**588**	**1376**

About Community Based Education Program

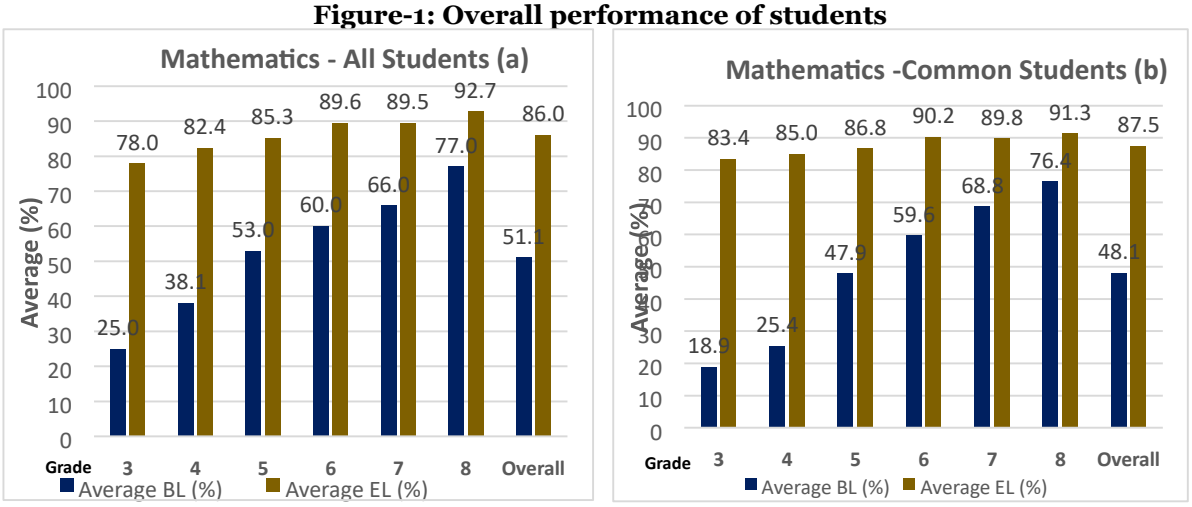
The prime objective of this intervention is to support children's learning and engage within community with various activities during school closure and support active participation in schools once they re-open. Therefore, to ensure the students participation in learning activities and provide individual attention, village level student groups consisting of 25 students each were formed. Mostly these are grade-based groups and planned 2-hour academic input sessions (on alternate day) by establishing Community Level Learning Centers (CLCs). These CLCs were led by a qualified partially paid Animators (Volunteers). Animators were trained on comprehensive plan to conduct academic and co-curricular activities to facilitate the sessions for students (face-to-face). Further, they were supplied with a workbook and learning materials for individual children to practice and acquire mathematical skills. The workbook was designed in view to develop basic competencies of mathematics. Monthly meetings of Volunteers/Animators were conducted to review the implementation, progress and provide additional inputs, if any.

The assessment tools developed by the investigator with referring *(National Achievement Survey-2017 published by NCERT and other reports)* resources available in relation to mathematical skills development and assessment with consulting various consultants and experts in the field of education. The intention of the assessment tools is to understand learning level of students in Mathematics. The tools consisting of 14 items (including oral & written) to assess the basic skills like understanding the numbers and numerals up to 1000, 2 digit additions with and without carrying over, subtraction of 2 digit numbers with and without borrowing, word problems on addition and subtraction, operation of multiplication and division to solve daily life problems, understanding of numbers in fractions of ½. 1/3, ¼. ¾. Further, as a part of this study appropriate process was followed while finalizing the assessment tools and checked the reliability and validity with using technical tool.

Analysis and Interpretation of the Data

The grade wise performance of students at the level of baseline and endline is presented here. The data reveals that the average overall endline score is higher than baseline score, with 34.9% gain in Mathematics (Figure 1). The average endline performance for Mathematics test ranges from 78% to 92.7% across the students of all classes. Common students scored in the range of 83.4% to 91.3%. Meaningful improvements are observed from baseline to endline with differences statistically significant, and large effect sizes.

Figure-1: Overall performance of students



Overall, 96% students scored above benchmark cut-off in Mathemetics. 30 to 69%-point increase is observed in the percentage of students above benchmark cut-off from baseline to endline. The study reported 30 to 50% increase in students scoring 'above 80%' in endline in Mathematics. The average endline scores are higher than baseline scores for all classes by 15.7% to 53% points for all students and 14.9% to 64.4% for common students between baseline and endline.

The study revealed that, girls have shown marginally higher improvements than boys in class III and VIII. Boys have performed better than girls in class IV, V, and VII. However, the difference is statistically significant in class VII with small effect size. A weak positive relationship is observed between the attendance percentage and student's performance in endline.

The performance in Mathematics oral, ranges from 67.2% to 97.9% across classes in Endline. 6.7% to 24.9% point improvement in mathematics oral is observed across classes. However, the difference in the performance is statistically significant in classes III & IV have shown the highest improvement over baseline.

Table-2: Overall Performance of Students

Class	Mathematics – All students				Mathematics – Common Students between BL and EL			
	Gain (ELBL)	Significance*	Cohens' d	Effect Size	Gain (ELBL)	Significance*	Cohens' d	Effect Size
Grade-III	53.0	Sig*	2.7	Large	64.4	Sig*	3.7	Large
Grade-IV	44.3	Sig*	2.1	Large	59.6	Sig*	3.2	Large
Grade-V	32.2	Sig*	1.6	Large	38.9	Sig*	1.9	Large
Grade-VI	29.5	Sig*	1.6	Large	30.6	Sig*	1.7	Large
Grade-VII	23.6	Sig*	1.2	Large	21.0	Sig*	1.0	Large
Grade-VIII	15.7	Sig*	1.0	Large	14.9	Sig*	0.8	Large
Overall	34.9	Sig*	1.5	Large	39.4	Sig*	1.6	Large

The analysis of students' performance in mathematics revealed (Table-2) significant gains (ELBL) across all grades for both all students and common students assessed between baseline (BL) and end-line (EL). The effect size, as measured by Cohen's d, was consistently large for all grades, indicating substantial improvement. Notably, the gain was highest in lower grades, with Class 3 showing the largest effect size (Cohen's d = 3.7 for common students), while the gains decreased progressively in higher classes. Overall, the combined results indicated a significant improvement with a large effect size (Cohen's d = 1.5 for all students and 1.6 for common students), underscoring the effectiveness of the intervention.

Skill-wise Performance result: This skill-wise result is an important observation from the research point of view to understand how students have performed on different skills. It also shows the high and weak performing skills among all the skills tested in each grade. The skillwise report shows the skill name and questions in each skill along with their average scores and SD for both baseline and endline tests. Skill-wise analysis of mathematics paper shows that among all the skills tested, students have scored exceptionally good in all skill, Students have scored in range of 53.9% to 96.7% across grades in this skill (Table 4 & 5). The lowest performance is in 'subtraction of 2 digit numbers with borrowing' across classes. Most of the skills tested across classes have shown the improvement by 5% to 61% points across classes.

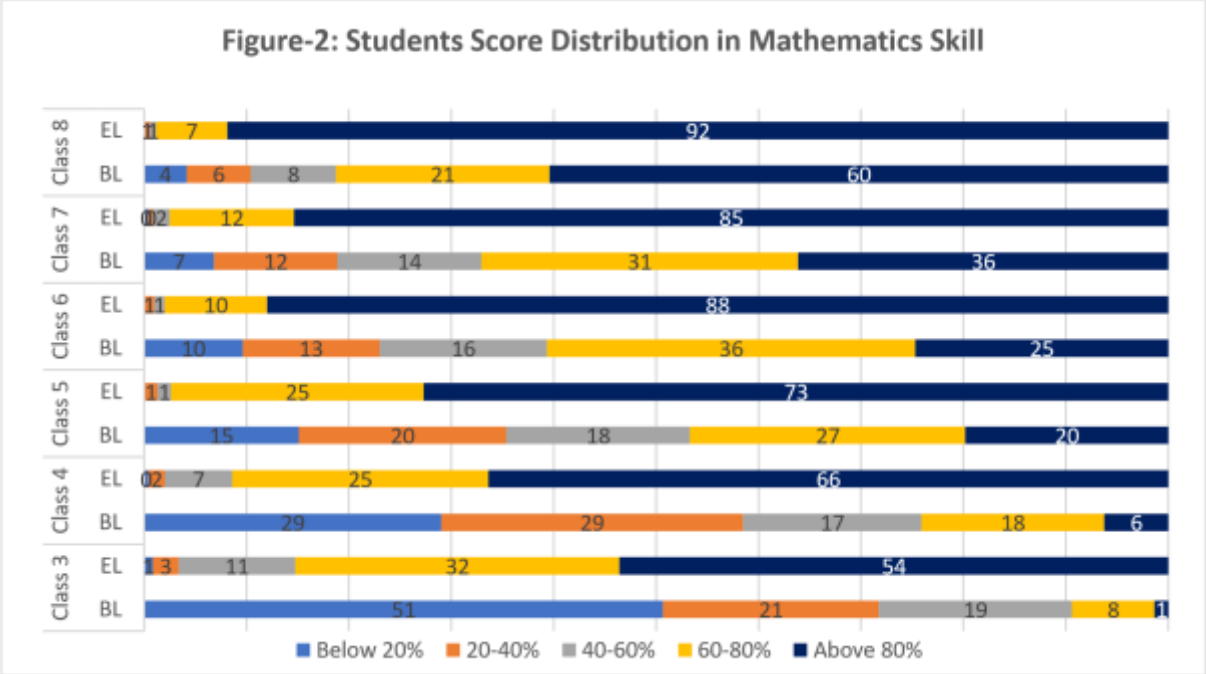
Table-3: Mathematics Skill performance among students of GradesIII to V

Sr. No	Skill Name - Math	Question	Sub Question (Items)	Class 3 BL	Class 3 EL	Class 4 BL	Class 4 EL	Class 5 BL	Class 5 EL
1	Understanding numbers and numerals upto 99	1, 3	8	45.2	89.2	61.7	93.5	73.3	94.5
2	Understanding numbers and numerals upto 1000	2,4,5,6,7	20	27.9	79.5	41.9	84.6	56.9	88.6
3	2 digit addition without carrying over	8	4	30.8	87.6	48.7	92.9	71.6	93.6
4	2 digit addition with carrying over	9	4	11.1	69.4	25.9	77.0	44.9	80.7
5	Subtraction of 2 digit numbers without borrowing	10	4	16.4	77.0	28.9	81.5	47.6	88.4
6	Subtraction of 2 digit numbers with borrowing	11	4	2.4	53.9	10.9	61.9	23.8	61.2
7	Word Problems on Addition and Subtraction	12	4	24.2	83.5	39.1	82.9	56.6	84.3
8	Operations of multiplication and division to solve daily life problems	13	4	14.8	73.7	16.2	76.1	31.4	76.2
9	Understands fractions ½. 1/3, ¼. ¾	14	4	20.4	70.5	30.8	70.8	35.5	77.5
	Overall		**56**	**25.0**	**78.0**	**38.1**	**82.4**	**53.0**	**85.3**

Table-4: Mathematics Skill performance among students of Grades VI to VIII

Sr. No	Skill Name - Math	Question	Sub Question (Items)	Class 6 BL	Class 6 EL	Class 7 BL	Class 7 EL	Class 8 BL	Class 8 EL
1	Understanding numbers and numerals upto 99	1, 3	8	78.1	95.9	81.9	95.8	89.2	96.7
2	Understanding numbers and numerals upto 1000	2,4,5,6,7	20	64.0	91.7	69.9	91.5	77.4	95.2
3	2 digit addition without carrying over	8	4	78.1	96.0	81.7	94.4	91.4	96.5
4	2 digit addition with carrying over	9	4	60.9	87.4	62.6	87.8	79.4	90.1
5	Subtraction of 2 digit numbers without borrowing	10	4	61.7	88.9	68.0	89.6	84.1	89.8
6	Subtraction of 2 digit numbers with borrowing	11	4	33.6	76.9	40.6	77.7	60.7	81.0
7	Word Problems on Addition and Subtraction	12	4	60.5	85.7	69.6	87.1	77.1	94.0
8	Operations of multiplication and division to solve daily life problems	13	4	29.1	80.8	39.1	84.3	54.7	88.2
9	Understands fractions ½. 1/3, ¼. ¾	14	4	40.6	87.9	48.7	83.2	65.4	89.4
	Overall		**56**	**60.0**	**89.6**	**66.0**	**89.5**	**77.0**	**92.7**

Students Score Distribution



The student score distribution data (Figure-2) shows that, in Mathematics, the percentage of students scoring 'below 20%' are Nil across grades in EL as compared to BL. A very few students are in lower scoring bands. About 54% to 92% students have scored 'above 80%' across grades in Endline. Primary (III to V) grades have observed significant shift from students scoring in lower bands to higher bands in comparison with higher primary (VI to VIII).

Major Findings

The findings of the present study are as follows,

• The average endline performance for Math test ranges from 78% to 92.7% across classes for all the students. Common students have scored in range of 83.4% to 91.3%.

• The average endline scores are higher than baseline scores for all classes by 15.7% to 53.0% for all students and 14.9% to 64.4% for common students between baseline and endline15.9 to 34.4%-point improvement in language oral is observed across classes.

• Meaningful improvements have been observed from baseline to endline with differences statistically significant with large effect sizes.

• Primary classes (III to V) have shown the highest improvement across classes in comparison with higher primary classes (VI to VIII).

Education Implications

Based on the results, the following educational implications can be drawn:

The primary goal of this intervention is to support children's learning and encourage students to persist in their education even under challenging circumstances. The study indicates that implementing such an innovative approach will help students acquire essential academic skills and stay engaged with various learning activities. In this context, developing learning strategies at the community level, with active participation from local resources and resource persons, will emphasize the importance of education and enhance academic performance. Additionally, this will help create an enabling environment to achieve the universalization of education and establish a high-quality education system in the country. Therefore, initiatives such as publicprivate partnerships and the involvement of community stakeholders have a significant impact on achieving universal education and delivering quality education.

Summary and Conclusion

The study findings suggest that a comprehensive and constructive design of intervention inputs effectively enhances students' learning levels. Community-based engagement involving the school system significantly reduced adverse impacts on enrolment, attendance, quality of teaching, learning, and children's overall well-being. To ensure student participation in learning activities and provide individual attention, village-level student groups, each consisting of 25 children, were formed. These groups were mostly grade-based and participated in planned 2hour academic sessions every other day at Community Learning Centers (CLCs).

Qualified and partially paid Animators/Volunteers led these centers. These animators were trained to conduct both academic and co-curricular activities through face-to-face sessions with the students. Additionally, workbooks and learning materials were provided to individual students to practice and acquire basic mathematics skills. As a result, students' academic performance improved, with average endline scores surpassing baseline scores by 15.7% to

53.0% across all classes. These kinds of interventions could be designed and implemented in various locations within the state to further validate and refine the results.

References

1.DemiR, F., Özdaş, F., & Çakmak, M. (2022). Examining the Learning Losses of Students in the Covid-19 Process According to Teachers' Opinions. *International Journal of Psychology and Educational Studies*, *9*, 1012–1026. https://doi.org/10.52380/ijpes.2022.9.4.978

2. Fraivillig JL, Murphy LA, and Fuson KC (1999). Advancing children's mathematical thinking in everyday mathematics classrooms. *Journal for Research in Mathematics Education,30:148170*
3. Khan, S., & Mohakud, L. L. (2022). *Covid-19 and Digital Divide in Higher Education: Exploring the Indian Scenario*.
4. *Learning loss during covid-19*. (2021). Azim Premji Foundation.
5. Roselyn A. Causing, Alfred G. Araquil, Lourabel Kizza Grace O. Baldove,Roden H.
6. Toreno (2021). Enhancing Numeracy Skills for Learners at the Margin Utilizing Concrete Manipulatives: A Community-Based Participatory Action Research: *International journal of research and scientific innovation ISSN 2320-5520*.
7. NCERT (2017). National Achievement Survey (Class III -VIII), National Report to inform policy, practices and Teaching Learning, released on 22nd Feb 2019
8. UNICEF. (2021). *Impact of Covid-19 on students living in Poverty*.
9. https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-86-thelong-term-impact-of-covid-19-on-poverty/