



## Learner Participatory Strategies is the Key to Competency in Mathematics and Integrated Science in Junior Schools

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### Abstract

Several research findings indicate that learners' proficiency in Mathematics and Integrated Science at the end of junior school remains below the expected standards. This study therefore examined the less researched learner participatory strategies in enhancing learners' competency in Mathematics and Integrated Science. The objective of this study was to examine the uptake of learner participatory strategies in enhancing competency of learners in Maths and Integrated Science in Junior Schools in Rachuonyo North Sub-county, Kenya. The study was guided by cognitive development and social cognitive theories. The study adopted a cross-sectional survey design and quantitative approach from a population that comprised 140 Heads of Institutions, 200 teachers and 5,000 grade seven learners, giving a total of 5,340 respondents. Using simple random sampling, 42 Heads of institutions, 60 teachers and 1,500 learners were selected. A structured questionnaire was administered to teachers and heads of institutions to collect information about the influence of participatory strategies of learners in Maths and Integrated Science competencies. A structured observation checklist was used in the observation of actual lessons in class. Validity and reliability of the instruments were established through consultation with experts and piloting. The structured questionnaire and observation checklist was piloted in schools outside the sampling frame using 4 heads, 6 teachers and 150 learners yielding a test-retest reliability of .79 and .81 for questionnaires and checklists respectively. Content validity indices of .78 and .75 were obtained making it suitable for collection of information. Data was analyzed using descriptive statistics and the study findings presented in form of frequency tables, means and graphs. The study findings established that proper implementation of participatory strategies will strongly and positively predicts the uptake of learner competency in Mathematics and Integrated Science. Although teachers possess adequate knowledge and understand their role in developing competent learners, this knowledge is not effectively translated into classroom practice. The study recommends continuous professional development, mentorship, and provision of adequate resources to bridge the gap between teachers' knowledge of participatory strategies and their actual classroom practice, thereby enhancing learner competency.

**Keywords:** Competency, Participatory, Strategies,

### Introduction

Participatory learning is an approach to teaching and learning which encourages learning by doing, using small groups, concrete materials, open questioning and peer teaching (INEE, 2024). It helps boost engagement level of students, helps them to understand concepts better, retain information and work together to solve problems, find solutions and more, thereby encouraging team building (Hanson, 2024). The more the students participate in classroom the more the feedback process becomes seamless (Hanson 2024). Participatory learning can include group work, brainstorming and discussions. These learner centered framework fosters discovery-based learning, bridges learning gaps, and prioritizes relevant skills over certification (Akala 2021; Oginni et al., 2021; Muchira et al., 2023).

Participatory learning strategies have become central to competency-based education, especially in promoting collaboration, problem solving, and self-efficacy among learners. Studies conducted globally show that group work and interactive teaching approaches enhance mastery and academic performance. Aikens and Kulacki (2023) found that group problem-solving builds self-efficacy and supports learning, although their work was restricted to students from only two courses at one institution. Similarly, Aguilera and Perales-Palacios (2020) reported that participative teaching improves attitudes toward science and academic performance, but their study was limited to a single school in Spain. Fujita et al. (2021) further demonstrated that collaborative work strengthens problem-solving competencies in mathematics in the UK and Japan, though implementation varies across contexts.



Despite global success in participatory learning, implementation in Africa faces challenges including limited teacher capacity and resource constraints (Isaboke et al., 2021; Mironga et al., 2021; Munyoki 2022). In Kenya, the shift from 8-4-4 to CBC aimed to address low concept mastery in junior schools (OCDE, 2020; Achieng', Oyoo, & Onditi, 2025), yet gaps persist in applying learner-centered pedagogy in schools.

Globally, concerns remain over learners' competency in numeracy and science, particularly in developing contexts (KICD, 2018; 2019). Studies reveal persistent deficiencies in concept mastery of mathematics and integrated science relative to grade level (Kerkhoff & Wakobuya, 2024; Ongesa et al., 2025). This study, conducted in Rachuonyo North Sub-County, therefore examines influence of participatory teaching strategies and competency development in Mathematics and Integrated Science, reflecting a broader national educational concern.

### Research Objective

- i. To examine the influence of learner participatory strategies in enhancing competency of learners in Maths and Integrated Science in Junior Schools in Rachuonyo North sub-county, Homabay County, Kenya.

### Research Question

- i. What are the most effective learner participatory strategies in enhancing learner competency in Maths and Integrated Science in Junior Schools?

### Methodology

The study adopted a cross-sectional survey design and targeted 140 Heads of Institutions, 200 teachers, and 5,000 Grade Seven learners of which a sample of 42 heads, 60 teachers, and 1,500 learners were selected through simple random sampling within Rachuonyo North sub-county, Homabay County, Kenya (Mugenda & Mugenda, 2009; Owuor et al., 2023). Grade seven learners were selected since it's the entry-level of Junior School which is relevant to understanding the early phases of participatory strategies in CBC implementation.

A structured questionnaire was administered to the heads of institutions and teachers to collect information about the influence of participatory strategies in enhancing competency of learners in mathematics and integrated science. Structured Observation checklists were used to assess classroom interactions, teaching practices, and learner behaviors during live lessons (Odima, 2023; Cherry, 2023). Validity and reliability of the study instruments were established through consultation with experts and piloting. The structured questionnaire and observation checklists were piloted in schools outside the sampling frame using 4 heads, 6 teachers and 150 learners. The Content Validity Index (CVI) was 0.784 for questionnaires and 0.75 for checklists—both above the acceptable threshold of 0.70 (Korir et al., 2023). Reliability was verified using the test-retest method, yielding coefficients of .79 and .81 (Mugenda & Mugenda, 2012; Middleton, 2023). The data was analyzed using descriptive statistics and the study findings presented inform of frequency tables, means and graphs.

## Results And Discussions

### Demographic Factors of the Participants

Table 1 shows the demographic factors of teachers that participated in the study. The response rate male and female was 67.02% and 32.08% respectively with majority of the teachers having degree qualification as their highest level of academic qualification. The study established that the majority of teachers were on permanent employment.

**Table 1: Demographic Factors of Teachers and Heads of Institutions**

Demographic Factor	Variables	Percentages
Gender	Male	67.02%
	Female	32.98%
Highest level of training	Diploma	21.29%
	Degree	78.71%

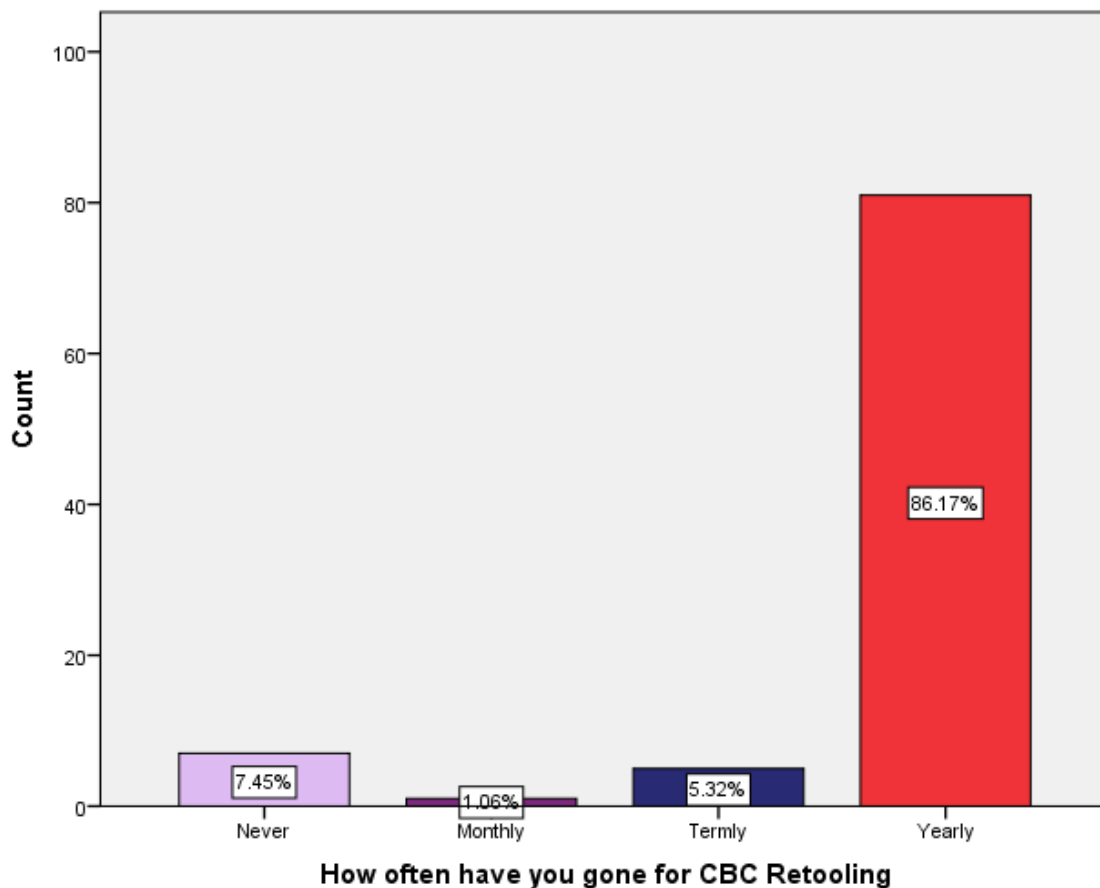


Nature of employment	Permanent	70.21%
	Internship	25.53%
	BOM	4.26%

### CBC Retooling.

Figure 1 indicates that most teachers (86.17%) goes for CBC Retooling yearly. Retooling is essential for effective implementation of Participatory learning strategies as a CBC teaching method. Retooling helps in shifting teaching towards learner-centered methods, it enhances core competency instruction, boosts teacher confidence, and ensures consistent, inclusive, and digitally supported learning experiences nationwide (Kalla et al, 2025). The researcher wanted to know the frequency of CBC re-tooling to find out whether the teachers are constantly re-tooled to become effective facilitators of learning in this CBC system. Junior school teachers should be re-tooled on how to bridge the gap between traditional teaching and 21<sup>st</sup> century educational goals.

Figure 1: CBC Retooling



### Results from Questionnaires

Teachers were presented with a list of aspects of participatory strategies used in enhancing competency of learners and were asked to rate their level of agreement based on the following key: **1= Strongly Disagree (SD); 2= Disagree (D); 3= Neutral (N); 4= Agree (A); 5= Strongly Agree (SA)**. The data obtained was analyzed through descriptive statistics and presented in terms of frequencies (F), percentages (%), Mean (M) and Standard Deviation (SD) as presented in Table 2.



**Table 2: Participatory Strategies in Enhancing Mathematics and Integrated Science Competencies.**

Aspect of Learner Participatory Strategies in Enhancing Competency of Learners in Maths and Integrated Science	R	Level of Agreement					M	SD
		SD	D	N	A	SA		
		1	2	3	4	5		
Frequent group work activities in lessons results in concept mastery	F	0	1	2	25	66	4.66	.578
	%	0.0	1.1	2.1	26.6	70.2		
Frequent group work activities improves writing quality of learners	F	4	5	8	23	54	4.26	1.097
	%	4.3	5.3	8.5	24.5	57.4		
Frequent brain storming activities improves learners thinking abilities	F	1	4	7	26	56	4.40	.884
	%	1.1	4.3	7.4	27.7	59.6		
Frequent brain storming discussions improves public speaking abilities of learners.	F	4	3	9	29	49	4.23	1.041
	%	4.3	3.2	9.6	30.9	52.1		
Frequent peer collaborative learning improves self-esteem in learners	F	0	2	7	24	61	4.53	.729
	%	0.0	2.1	7.4	25.5	64.9		
Collaborative learning in Maths and Integrated Science enhances problem solving skills in learners	F	0	1	9	29	55	4.47	.714
	%	0.0	1.1	9.6	30.9	58.5		
Participatory teaching approach promotes positive attitude towards Maths and Integrated Science.	F	0	0	12	32	50	4.40	.708
	%	0.0	0.0	12.8	34.0	53.2		
Frequent cooperative learning promotes in-depth learning in Maths and Integrated Science	F	0	0	7	26	61	4.57	.631
	%	0.0	0.0	7.4	27.7	64.9		
Frequent student – student academic interactions improve the academic achievement in Maths and Integrated Science.	F	1	1	6	24	62	4.54	.757
	%	1.1	1.1	6.4	25.5	66.0		
Frequent use of group thinking trains competent learners.	F	1	5	11	23	54	4.32	.953
	%	1.1	5.3	11.7	24.5	57.4		
Peer collaborative online learning trains digitally literate learners.	F	1	0	7	18	68	4.62	.434
	%	1.1	0.0	7.4	19.1	72.3		

The analysis in Table 2 revealed that 96.8% of respondents strongly agreed that frequent group work enhances concept mastery ( $M = 4.7$ ,  $SD = 0.578$ ), indicating strong consensus. This aligns with Aikens and Kulacki (2023) and Lan and Van (2021), who found that collaborative tasks promote conceptual mastery. It underscores the need for Junior School teachers to integrate group work strategies that enhance understanding, retention, and learner engagement (Achieng', Oyoo & Onditi, 2025).

Similarly, 81.9% of respondents agreed that group work improves writing quality ( $M = 4.3$ ,  $SD = 1.097$ ), consistent with Moonma and Kaweera (2021) and Kamau et al. (2020), who found that collaboration enhances writing and critical thinking. This suggests that peer discussions in Mathematics and Integrated Science promote deeper reasoning and exposure to diverse solution strategies.

Regarding brainstorming, 87.3% agreed that it improves learners' thinking abilities ( $M = 4.4$ ), while 83.0% believed it enhances public speaking ( $M = 4.2$ ,  $SD = 1.041$ ). These results echo Ningsih et al. (2024) and Octarina et al. (2021), who demonstrated that brainstorming broadens thinking capacity and communication skills, fostering creativity and confidence among learners.

Peer collaborative learning was also found to boost self-esteem (90.4%,  $M = 4.5$ ,  $SD = 0.729$ ), supporting Adene et al. (2003) and Low et al. (2024), who linked collaboration to improved self-confidence and social-emotional competence. Likewise, 89.4% agreed that it enhances problem-solving skills ( $M = 4.5$ ,  $SD = 0.714$ ), corroborating Fujita et al. (2021), who emphasized teamwork's role in tackling complex tasks.

Participatory approaches were reported to promote positive attitudes toward Mathematics and Integrated Science (87.2%,  $M = 4.4$ ,  $SD = 0.708$ ), consistent with Aguilera and Perales-Palacios (2020) and Onthancee (2020). Similarly, 92.6% affirmed that cooperative learning fosters deeper understanding ( $M = 4.6$ ,  $SD = 0.631$ ), aligning with Sibomana et al. (2021) and Tendesse et al. (2024).

Additionally, 91.5% of respondents recognized peer interaction as a key contributor to achievement ( $M = 4.5$ ,  $SD = 0.757$ ), in line with Ogot et al. (2020). 81.9% agreed that group thinking fosters learner competence ( $M = 4.3$ ),



as supported by Gyimah (2023). Finally, 91.4% confirmed that collaborative online learning enhances digital literacy ( $M = 4.6$ ,  $SD = 0.434$ ), supporting Bach and Thiel (2024), who emphasized its role in developing digital skills and improving online engagement.

### Results from Observation Checklist

To effectively answer the research question, which stated that: ‘What are the most effective psychometric perspective of learners’ participatory strategies in enhancing learner competency in Mathematics and Integrated Science in junior schools in Rachuonyo North Sub- County, Homabay County, Kenya? The study investigated the difference between what the respondents know should be done and what is actually being practiced in class. The researcher rated the level as to which the learners were engaged in class as: **1 = Never (N)**; **2 = Rarely (R)**; **3 = Moderate (M)**; **4 = Most of Time (MT)**; **5 = Always (A)**. This was done with the aid of observation checklist. The data obtained was analyzed through descriptive statistics and presented in terms of frequencies (F), percentages (%), Mean (M) and Standard Deviation (SD) as presented in Table 3.

**Table 3: Analysis of Observation Checklist Results on Participatory Strategies.**

Items of Participatory Strategies	R	Level of Engagement					M	S d S D SD
		N 1	R 2	M 3	MT 4	A 5		
Teacher uses group work activities in lesson to enhance mastery of Maths and Integrated Science concepts.	F %	12 38.7	17 54.8	1 3.2	1 3.2	0 0.0	1.71	.693
Teacher uses group work activities to enhance quality of writing of learners.	F %	13 41.9	16 51.6	1 3.2	1 3.2	0 0.0	1.68	.702
Teacher uses brainstorming strategy to improve learners’ ability to answer questions.	F %	11 35.5	17 54.8	2 6.5	1 3.2	0 0.0	1.77	.717
Teacher uses peer collaborative learning to boost learners’ self-esteem in Maths and Integrated Science	F %	11 35.5	18 58.1	1 3.2	1 3.2	0 0.0	1.74	.682
Cooperative learning is used in class.	F %	10 32.3	19 61.3	1 3.2	1 3.2	0 0.0	1.77	.669
Teacher employs Participatory strategy in teaching of Maths and Integrated Science	F %	2 6.5	20 64.5	8 25.8	1 3.2	0 0.0	2.26	.631
Learners are given collaborative work in Maths and Integrated Science to improve problem-solving skills	F %	9 29.0	20 64.5	1 3.2	1 3.2	0 0.0	1.81	.654

Table 3 shows that more than half of the teachers (54.8%) rarely used group work, while 38.7% never applied it, resulting in a low mean of 1.7 out of 5. Similar low usage was observed for brainstorming ( $M = 1.8$ ), peer collaborative learning ( $M = 1.7$ ), and cooperative learning ( $M = 1.8$ ). These findings indicate that although teachers recognize the value of participatory strategies (as shown in Table 1), such approaches are seldom practiced in classrooms. Observations further confirmed a clear gap between teachers’ reported beliefs and their actual instructional practices in Mathematics and Integrated Science.

This limited application contradicts earlier research highlighting the effectiveness of participatory methods in improving conceptual mastery, problem-solving, and engagement. Studies by Gillies (2020) and Low et al. (2024) affirm that group work enhances understanding and retention, while Obafemi (2022) and Wang et al. (2022) found brainstorming and peer collaboration to strengthen critical thinking. Similarly, Tadesse et al. (2024) demonstrated that cooperative learning improves academic engagement compared to lecture-based methods. Despite this evidence, teachers’ reluctance to adopt participatory strategies is linked to challenges such as syllabus pressure, large class sizes, and inadequate resources. Concerns about noise, indiscipline, and classroom control during open discussions also discourage implementation (Ochieng’, 2021).



Structural and institutional barriers further compound the issue. Overcrowded classrooms, limited teaching materials, and insufficient administrative support reduce opportunities for collaborative learning (McDuffie et al., 2022; Solis et al., 2020). Teachers also cited the heavy workload of planning and supervising group activities and the need to meet syllabus deadlines as major deterrents (Murawski & Lochner, 2022).

These findings emphasize the urgent need for systemic interventions to bridge the gap between knowledge and practice. Professional development programs should focus on classroom management and participatory pedagogy, while school leaders should create supportive environments—through smaller class sizes, adequate resources, and flexible timetables. Aligning participatory methods with content goals could ensure curriculum coverage while fostering learner competency.

#### ANOVA Statistics for Participatory Strategies in Junior Schools

ANOVA analysis was done and used to determine the effect of independent variable (participatory strategies) on dependent variable (competency of learners) as shown in table 4

**Table 4: ANOVA table on Participatory Strategies in Enhancing Competency of Learners**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	25.944	10	2.594	9.670	.000
	Residual	22.269	83	.268		
	Total	48.213	93			

From table 4, the high F-value and the low p value (F= 9.670; P= .000) show that the model is statistically significant ( $p < .05$ ). This means that participatory strategies significantly predicts the dependent variable (competency of learners in Mathematics and integrated Science in Junior Schools in the study area. The measurement of participatory strategies of learners have a meaningful (statistically significant) positive influence on the competency of learners in Mathematics and Sciences in Junior Schools

**Table 5: Model Summary of Participatory Strategies on Competency**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.734 <sup>a</sup>	.538	.482	.518

Table 5 show the coefficients (R) which represents the measurement of participatory strategies which was the predictor variable in this model. Because the coefficient for the predictor is positive, the dependent variable increases as the predictor increases. Therefore, participatory strategies when properly implemented will positively and strongly ( $r = .734, p = .000$ ) predict the uptake of competency of learners in Mathematics and integrated Science in Junior Schools.

#### Conclusions and Recommendations.

The study found that there was a strong positive relationship between participatory activities and learner competency, indicating that increased use of this strategy improves performance in Mathematics and Integrated Science. However, classroom observations showed limited application, revealing a gap between teacher beliefs and actual practice.

The study recommends continuous in-service training workshops organized by Ministry of Education in collaboration with Teachers Service Commission and Kenya Institute of Curriculum Development to build teachers' capacity in using participatory strategies. School management should invest in low-cost, locally available teaching aids and materials that supports hands-on activities and exploratory learning, emphasizing participatory activities that can strengthen teaching and improve learner competency.



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