Teaching and Learning in Fragile Contexts (TLFC) Policy Brief

Improvised Mobile Science Kit

Enhancing Scientific Literacy Among Grade 4 Learners in Kakuma Refugee Camp Using an Improvised Mobile Science Kit

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INTRODUCTION.

This research focused on the use of an Improvised Mobile Science Kit to promote science literacy in fragile contexts and its alleviation of lack of resources to promote science literacy. Kakuma refugee primary schools lack resources for teaching, classes are overcrowded, desks are inadequate, and teacher capacity needs to be increased especially in the implementation of the competency-based curriculum (CBC). Physical environments such as adverse weather, limited resources like food, water, sitting space also took a toll on the instructional program.

This research is a pilot study done in Kakuma refugee camp in Kenya. It is purpose was to find out how an Improvised Mobile Science Kit can enhance scientific literacy in Class four learners. This report commences by giving a brief background of the necessity of the use of the Improvised Mobile Science Kit in the teaching and learning of integrated science in fragile contexts.

The report explains the objectives and hypotheses that guided the study. The methodology used is outlined. The findings of the study are discussed which include the results from the pre-test and post-test leaner's achievement test, classroom observation schedule and teacher's questionnaire in line with the integrated science learning outcomes.

Background

In the teaching and learning of science, labs are of immense importance for science to be taught and learned effectively. Labs provide learners the chance to experiment, discover, and build skills that go far beyond the textbook. Despite this, in almost all fragile educational contexts, where meager or no resources exist, teaching occurs theoretically or sometimes teachers are forced to improvise. They use locally available materials to make substitutes for standard equipment – for instance in place of beakers one could use plastic bottles, components from old electronics can be used to instruct electricity and electronics. These innovations bring life into science classrooms, but they are also associated with lots of challenges that affect learners' academic achievement.

Why the study is significant.

This study points out that Improvised Mobile Science Kits are useful in teaching to improve scientific literacy in this period of implementing the competency-based curriculum in Kenya. It enables the learners to:

- Improve the learner's interest and participation in learning integrated science.
- Gives learners the opportunity to have hands-on (practical) activities in integrated science.
- It helps the learners to develop manipulative science skills.
- It supports the development of confidence in science learning.
- It improves retention of the concepts learned.

Recommendations

- Schools should consider using the Improvised Mobile Science Kit. This may call for adjustment or redrawing of the education policies
- There is need for additional training, capacity building and support for teachers to maximize the instructional effectiveness of the Improvised Mobile Science Kit.
- There is need to improve storage facilities to protect and maintain the kit and other resources for science instruction.
- There is a serious need for indigenous local-context research to evaluate the kit's adaptability, cultural relevancy and efficacy.
- There is need for contextual proper teacher training, improved material design and continuous support (constant re-tooling) to enhance scientific literacy.

METHODOLOGY

The four comprehensive primary schools used in the study are known as host schools which means they host refugees and community learners. The four schools sampled include Kakuma Arid Zone, Kakuma Mixed, Pokotom and Kalemchuch Comprehensive Schools.

Tests were administered to Grade 4 pupils in two control schools and two treatment schools. The control schools were Pokotom

and Kakuma Mixed, while the treatment schools were Kalemchuch and Kakuma Arid Zone. In the control schools, teaching was conducted without the use of improvised science kits, after which both a pre-test and a post-test were administered. In the treatment schools, pupils were initially taught without the use of an improvised science kit, and their pre-test scores were recorded. The same class was then taught the subject using the improvised science kit, after which a post-test was administered

RESULTS

The findings of the pilot study provided important insights on how the use the Improvised Mobile Science Kit enhanced scientific literacy in the refugee settings to improve the science learning outcomes in fragile contexts. They also provided insights on science instruction in Kenya for formulating recommendations at the end of this report. The results were obtained from the analysis of the pre-test and post-tests based on each of the four hypotheses of the study together with analysis of the teacher's questionnaire and class observation schedule.

Learner's Understanding

Research Question: Is there a significant difference in learners' understanding of integrated science concepts between those taught using Improvised Mobile Science Kit and those taught using traditional teaching methods?

Learners in treatment schools showed significant improvement

Kakuma Arid Zone. In treatment school, Kakuma Arid Zone, a paired samples t-test was conducted to determine whether the use of improvised science kits had a significant effect on Grade 4 learners' performance. The SPSS output is shown table 1 & 2 below. The results showed that the **mean score increased** from pre-test (M = 13.78, SD = 4.67) to post-test (M = 15.28, SD = 4.62), indicating an improvement in learners' performance after the intervention. Further analysis using the paired samples t-test revealed that this difference was **statistically significant**, $t(115)=-5.864, p<0.05$. The mean difference was -1.509, with a 95% confidence interval ranging from -2.018 to -0.999. Since $p<0.05$, the null hypothesis is **rejected**. The findings indicated that the use of improvised science kits significantly improved learners' understanding and performance in the subject. The study also showed that the use of improvised science kits had a **significant positive effect** on Grade 4 learners' academic performance. Learners who were exposed to the improvised materials performed better compared to when conventional teaching methods were used.

Table 1. Pre and post testing at treatment school Kakuma Arid Zone School

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE-TEST	13.78	116	4.670	.434
	POST-TEST	15.28	116	4.621	.429

Table 2. Pre and post testing at treatment school Kakuma Arid Zone School

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE-TEST - POST-TEST	-1.509	2.771	.257	-2.018	-.999	-5.864	115	<.001

Kalemuchuch. A similar paired samples t-test in treatment school Kalemuchuch was conducted to examine the effect of improvised science kits on learners' academic performance. The SPSS output is shown table 3 & 4 below. The results indicated that the mean score increased from pre-test (M = 11.73, SD = 4.82) to post-test (M = 14.04, SD = 4.87), suggesting an improvement after the intervention. The paired samples t-test table 9 revealed that this difference was **statistically significant**, $t(91)=-4.747, p<0.05$. The mean difference was -2.315, with a 95% confidence interval ranging from -3.284 to -1.346. This indicates that the use of improvised science kits had a significant positive effect on learners' performance.

Table 3. Pre and post testing at treatment school Kalemuchuch

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE-TEST	11.73	92	4.818	.502
	POST-TEST	14.04	92	4.872	.508

Table 4. Pre and post testing at treatment school Kalemuchuch

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE-TEST - POST-TEST	-2.315	4.679	.488	-3.284	-1.346	-4.747	91	<.001

Learners at control schools showed no improvement

Kakuma Mixed. At control school Kakuma Mixed, the SPSS output was as shown table 5 & 6 below. The results showed that post-test scores (M = 10.06, SD = 5.49) were slightly lower than pre-test scores (M = 10.58, SD = 6.06). However, this difference was **not statistically significant**, $t(68)=1.798, p>0.05$. The mean difference was 0.522, with a 95% confidence interval ranging from -0.057 to 1.101.

Table 5. Pre and post testing at control school Kakuma Mixed

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PER-TEST	10.58	69	6.064	.730
	POST-TEST	10.06	69	5.485	.660

Table 6. Pre and post testing at control school Kakuma Mixed

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PER-TEST - POST-TEST	.522	2.411	.290	-.057	1.101	1.798	68	.077

Pokotom. At control school Pokotom, the SPSS output was as shown table 7 & 8 below. The results indicated that post-test scores (M = 11.00, SD = 5.34) were also slightly lower than pre-test scores (M = 11.45, SD = 5.53). This difference was statistically significant, t(52)=3.539, p<0.05, with a mean difference of 0.453 and a 95% confidence interval ranging from 0.196 to 0.710.

Table 7. Pre and post testing at control school Pokotom

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE-TEST	11.45	53	5.528	.759
	POST-TEST	11.00	53	5.335	.733

Table 8. Pre and post testing at control school Pokotom

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE-TEST - POST-TEST	.453	.932	.128	.196	.710	3.539	52	<.001

Teacher's Challenges

Research question: What challenges do teachers face in the use of Improvised Mobile Science Kit resources to improve scientific literacy?

The findings in Table 9 indicate that teachers generally agree they face challenges in using mobile science kits, particularly due to limited instructional time, large class sizes, and difficulties replacing materials. However, challenges related to storage and the need for

additional training showed higher variability, suggesting that these issues are context-dependent.

Table 9. Mean scores for teacher challenges.

Statistics

		Q1	Q2	Q3	Q4	Q5
N	Valid	8	8	8	8	8
	Missing	0	0	0	0	0
Mean		1.75	1.63	1.75	2.00	2.00
Mode		1	1	1	1	1
Variance		1.071	1.125	1.071	1.714	1.714

Overall, while the mobile science kit is beneficial, its effective implementation is constrained by both structural and capacity-related factors. There is a need to address time constraints, improve resource provision, and offer targeted professional development to ensure effective and consistent use of mobile science kits across different school contexts.

KEY FINDINGS

- The improvised mobile science kit promotes hands on learning thereby enhancing understanding and references of scientific concepts thus improves acquisition of 21st century skills that increase scientific literacy.
- Improvised materials can effectively substitute conventional laboratory equipment especially in resource- constraint environments such as Kakuma refugee camp.
- It is notable that during transition to CBC teachers in primary schools in Turkana county, especially Kakuma refugee camps, have encountered numerous difficulties with teaching methods and lack of materials. They lack plant and animal material because not many plants and animals are found in semi-arid and arid region.
- It requires proper training of teachers, improved design of the materials, continues support and constant reference to the mobile science kit user manual.
- Learners struggle with trauma of war, poverty and of physical, emotional and academic challenges endured by refugee learners in semi-arid and arid regions.
- Gender parity is another challenge; the girls are not well equipped with sanitary pads and often skip attending school due to poverty, and gender and culture.
- Crisis of lack of resources expose gaps particularly in meeting basic needs like food, sanitary pads, poverty and risk of drop out due to early pregnancy.

RECOMMENDATIONS

1. Use of the Improvised Mobile Science Kit should be considered for adoption for its ability to provide alternative sources of T/L resources to supplement the lack, especially the lack of plant and animal material in the Arid and Semi-Arid lands as in Turkana County. This may require policy review.
2. The integration of mobile labs into national education strategies has significant implications for academic achievement. Policymakers should invest in training programs that equip teachers with skills to improvise, manage, and contextualize experiments. Professional development should emphasize inquiry-based pedagogy and safety protocols.
3. Teacher capacity should be built for improvisation while the teacher is in service training so that as they graduate, they are equipped to deliver during the instructional process.
4. Provide more training on integrating local materials to supplement the Improvised Mobile Science Kit especially when class sizes exceed 40.It is proposed that the class size policy be reviewed since the current class size policy in not in effect.
5. Provide adequate storage facilities to store the durable and re-usable T/L resources improvised by the teacher. Encourage teachers to motivate the learners to apply the knowledge they have gained from the learning of integrated science to solve everyday challenges, such as water filtration, the separation of substances, and maintaining a clean environment. Policy on improvisation and storage of instructional materials should be enacted.

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