

Use of mind mapping in developing students' comprehension skills in Kiswahili in secondary schools in Kakamega North Sub-County, Kenya

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ABSTRACT

Kiswahili is among the most widely used languages for communication in the most parts of the world. Nevertheless, a considerable number of secondary school students continue to experience difficulties in comprehension, including understanding important ideas in written texts. Conventional teaching methods seem inadequate to assist as they limit students' engagement. This study therefore determined the effect of mind mapping as an instructional strategy on developing Kiswahili comprehension skills among secondary school students. The study was anchored in Jerome Bruner's (1966) Constructivist Learning Theory and employed a Solomon Four-Group quasi-experimental design. A target population was form three students from Kakamega North Sub-County, in Kenya with a sample size of 205 was used as experimental and control groups. Purposive Random sampling technique was employed to four secondary schools. Data was collected using Kiswahili performance tests as pretest and posttest. Data was analyzed using descriptive statistics that involved the use of means and standard deviations and inferential statistics which involved t-test and two-way Analysis of Variance (ANOVA) to compare pretest and posttest. Results of the study indicate significant differences between control groups and experimental groups in Kiswahili Achievement Test. The finding showed that experimental groups outperformed the control groups in Kiswahili achievement posttest. The study concluded that mind mapping improved students achievement in Kiswahili. It was recommended that the use of mind mapping be encouraged in teaching and learning of Kiswahili due to its positive effect on developing students' comprehension skills. It is hoped that the findings of this study would help secondary school teachers to successfully apply mind mapping strategy in teaching to develop students' comprehension skills.

Keywords: Comprehension, Kiswahili, Mind Mapping, Students, Teaching

I. INTRODUCTION

Reading comprehension is fundamental to academic achievement and to learners' ability to function effectively in an information-based society because much academic learning depends on understanding written material. When secondary school students have difficulty making meaning from a text, they are likely to perform poorly in questions that require comprehension, application, or interpretation. The concern is particularly important in Kiswahili because the language is taught and examined as a core subject throughout Kenya's basic education system and also serves as both a national and an official language. Its constitutional status gives the language an important role in national identity, communication, and integration. It is a language that is also being used for broadcasting in Kenya, Africa and many world broadcasting corporations at large. Secondary school learners are therefore expected to develop sufficient reading proficiency to understand and respond to Kiswahili texts. Despite the critical role that Kiswahili plays internationally, nationally and regionally, Kenya National Examination Council (KNEC) reports have found instances of poor performance in sections which require understanding, such as part of the Kiswahili Papers 2 (Sika, 2023). Over half of candidates have been reported for some tasks in comprehension for obtaining a mark of less than half of the mark available. The difficulty is particularly true for questions that demand more than simple recall, such as applying information, analyzing the text, making vocabulary inferences, or synthesizing a syntactically sound sentence which captures the intended meaning. These patterns show that decoding or recognizing words' meaning is not solely a matter of whether you can say them or whether you can read them, but of whether you can process, understand and communicate meaning from written Kiswahili.

Students' poor performance in Kiswahili is associated with various factors including attitude, motivation and teaching instruction among other factors. The convention instructional methods seem to be inadequate and a major factor contributing to students' poor performance in Kiswahili. Using the right strategy to teach can make a big difference on how well students comprehend. Kiong et al. (2012) mention that the strategies used by teachers to teach affects how well students learn.

In learning, creative strategy of mind mapping can help students to remember and process information (Astriani *et al*, 2020). Tony Buzan, a British psychologist is the author of *Mind Mapping*, commonly referred to as the brain or the mind map in the 1960s, as a creative way to think (Liu *et al.*, 2018). It is a non-linear learning method that uses a central image to symbolize a key idea before branching out into numerous branches where more ideas are connected to it (Su *et al*, 2021). Mind mapping is one of the learner-centered approaches that has been adopted in teaching of science subjects with positive results. It is a strategy that can be used for stimulating thought process and encourage creativity among learners (Bewanah, 2019; Nasution, 2020). Thus the current paper investigated the use of mind mapping in developing students' comprehension skills in Kiswahili in Secondary schools, Kenya.

1.1 Statement of the Problem

Performance in Kiswahili has been a matter of concern despite the extensive national, regional, and global nature of the role of the language. Many secondary students still struggle with comprehending what they read. With reference to the KNEC report of 2020-2024, a significant percentage of candidates failed to reach the set standards in Comprehension and Interpretation. This indicates a continued need of teaching methods that will improve learners' capacity to comprehend written Kiswahili utterances.

Table 1

Performance trend in Kiswahili subject analyzed KCSE for Kakamega North Sub County

Year	2020	2021	2022	2023	2024
Entry	4019	34806	5315	5345	5977
Mean Score	5.107	4.909	4.1	5.597	5.626
Maximum Score	12	12	12	12	12
Mean Grade	C-	C-	D+	C-	C
Maximum Grade	A	A	A	A	A
Deviation	0.33	-0.198	0.8	1.5	0.029

Source: Sub county Director of Education (SDEO), Kakamega North KCSE results for the year 2020-2024

Table 1 show that Kiswahili performance in the Sub-county of Kakamega North was below the desired level in all five years. The mean grades of these varied between D+ and C, with a maximum grade of A possible. Many learners were not consistently achieving well in the subject, as indicated by the pattern. Part of this may involve lack of comprehension or remembering of information in written texts. The problem is not limited to any locality only, since comprehension problems have also been reported on the general level among learners of Kiswahili.

Teaching methods that actively engage students as they read and interpret are needed to tackle these challenges. A variety of strategies can be implemented to enhance reading comprehension, some of which may be more appropriate given the needs of the learners, the complexity of the text, and the nature of the classroom setting.

Mind mapping is one such approach where keywords or a concept are chosen, with related ideas being branches and related keywords that are added onto these. The introduction of the words on one of the branches can lead to other ideas or to the identification of how a part of the text relates to the main idea. This visual format can help students link concepts together, recognize connections, generate sentences with known content, and/or think creatively about the content. Although mind mapping has produced positive outcomes in subjects such as Science, Mathematics, and English, evidence on its use in Kiswahili remains limited. The study therefore investigated the effect of mind mapping on developing students' comprehension skills in Kiswahili in secondary schools.

1.2 Research Objective

The main objective of the study was to determine the effect of Mind Mapping on developing students' comprehension skills in Kiswahili.

II. LITERATURE REVIEW

2.1 Theoretical Review

The study was informed by the constructivist theory of learning, pioneered by Bruner (1966). Learning is a process of organizing and constructing knowledge, with new experiences connected to previous knowledge and understanding (Chiu & Yang, 2019). If you take a constructivist view, understanding is an active process of meaning-making, not an uptake of information or a message. The learners "read into the text," based on previous knowledge, sensory experiences and interactions with the environment in which they are learning (Tobin, 1993). Thus, some background information is essential, as it offers a framework to which new knowledge can be related. This constructivist aspect is reflected in mind mapping as learners relate ideas and experiences to those already held in their minds to link

with new content. Constructivist learning also assumes that new understanding is built on knowledge that the learner already possesses. Existing cognitive structures provide a foundation for interpreting new information, meaning that the capacity to learn develops as knowledge becomes richer and more connected. Teachers can use mind maps both to present relationships among ideas and to examine how students have understood them.

In recent years, there has been more focus on constructs based on constructivist learning theory, where learners need to be actively involved in the construction of their knowledge (Dhindsa & Anderson, 2011).

Instructional methods provide teachers with organized ways of facilitating classroom learning. An effective method that guides classroom practices, shapes how learners will interact with content and determines practice and feedback opportunities. These practices matter in all forms of education as they can enhance students' involvement and understanding of material (Zouhor, Bogdanovic, Skuban, & Pavkov-Hrvojevi, 2017). Kumaravadivelu (1994) had stressed that teachers should use a range of techniques and not rely on just one routine that they practice in the classrooms and to produce learning situations when addressing different purposes and the needs of learners. These methods allow for the decrease in an overload of the passive reception of information; they enable students to deal, process, reorganize and 'rebuild' information for themselves. However, they are also applicable in the context of working memory limitations, since it becomes possible to represent important ideas in smaller, interconnected units instead of one large block of information. A mind map can play its part in this process as the learner must choose the language, find the relationship between the language components and create their own knowledge representation. If knowledge is perceived as a system composed of concepts and propositions, then the strategies to reveal these relationships are particularly effective (Kurniasih & Irpan, 2019).

Tony Buzan, a renowned British psychologist, introduced mind mapping, commonly referred to as the brain or the mind map, in the 1960s as a creative way to think (Liu *et al.*, 2018; Wu and Wu, 2020). Mind maps have been employed in many different areas since their development; yet, they have also become a subject of educational research recently (Evrekli *et al.*, 2010). Mind mapping is a nonlinear learning method that uses a central image to symbolize a key idea or problem before branching out into numerous branches where more ideas are connected to it in a manner similar to how the human brain works (Su *et al.*, 2021). Mind map is an organizational graphic technique that can be applied to all aspects of life where improved learning and clear thinking will enhance performance and effectiveness. It is a nonlinear way of organizing information; a strategy that allows the capture of natural flow of ideas. According to Buzan, mind mapping is an innovative thought strategy that reflects the brain's way of working. It allows the brain to use all of its images and associations in a radial internal pattern. It is the simplest way to organize knowledge that comes from the brain. Mind mapping is a method of reading that can be both creative and effective. It literally maps out our thought. Nemat *et. al* (2014) defined this strategy as an expression of Radiant thinking and therefore a natural function of the human mind.

The established instructional methods seem to be inadequate and a major factor in students' poor performance in Kiswahili. A substantial amount of research shows that the achievement of learners in a specific subject is usually a reflection of instructional strategies applied by the teachers, Rizqya (2021). To help students improve on understanding what they read, it's important for them to find reading an interesting activity. According to Isreal, *et.al*, (2020), visual teaching tactics such as the usage of mind maps could help 65 percent of visual students learn more effectively.

For this study, constructivism provided the theoretical basis for using mind mapping in the teaching and learning of Kiswahili comprehension. The approach assumes that learners actively draw on existing knowledge structures while integrating new information into memory. New learning is therefore not stored separately from previous experience; it is interpreted through what the learner already knows and reorganized as relationships become clearer. In Kiswahili comprehension lessons, this process can occur when students identify conceptual relationships among ideas, events, key words, and topics in a text. A mind map makes these relationships visible and can be changed as the learner develops a more complete understanding. The strategy was therefore treated as a constructivist learning technique capable of promoting creativity, individual meaning making, and the use of higher-order thinking.

2.2 Empirical Review

Boyson (2009) studied mind mapping for educational purposes with nine students. The maps were used to take notes, organize information for presentation, learn in the classroom, and for homework. Specific benefits the participants mentioned were that mind mapping assisted in information recall 80% of the time, it helped them see how topics could relate 72% of the time, and it helped them revise the topics 75% of the time. In view of these findings, it was recommended that mind mapping be mastered as early as possible so that it would be used easily by learners for organizing ideas for the study and preparation for tests/exams. Nong *et al.*, (2009) studied a sample of 90 first-year students of a teacher-training college in Thailand who used digital mind mapping and traditional approaches. This was a study in which participants were assigned to various teaching conditions that included the use of computer-based mind maps, traditional teaching, and mental drawing on paper with pre- and post-testing. Students showed a preference for the mind mapping technique to conventional teaching. The computer-based maps were found to help clarify

relationships among concepts, assist with the classification of ideas, help in the building of new knowledge, and help to structure problem solving and critical thinking.

Siriphanich *et al.*, (2010) in a study with 35 learners obtained positive results in terms of students' reading ability improvement and student responses to their understanding. There was also a higher level of engagement in the classroom and a greater focus on fact and detail. In another study, Risqiya (2013) also confirmed that students liked to make mind maps, and found it interesting and thereafter used it to show their creativity and to be more active during the learning sessions.

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Waqad (2009) studied the application of mind mapping in Biology with the secondary female students in Grade One in Makkah city. The population consisted of 139 learners, while the experimental group consisted of 27 and the control group consisted of 28 learners, for a quasi-experimental study. The selected topics were prepared in a teacher guide through content analysis and an achievement test was developed and implemented to see the pre and post-test results of the topics. The memorization level did not show significant differences between groups by statistical analysis. But there were differences at higher cognitive levels: higher cognitive levels—understanding, application, analysis, and synthesis, and the combined cognitive score. This pattern suggests that mind mapping might have a better role to play in helping students organize and process information, rather than simple recall. It was suggested that for science teachers, promoting the use of mind maps needs to be encouraged, workshops on the use of mind maps should be conducted and training should be provided to allow teachers to use the technique effectively in science classrooms.

Elabady and Jradat (2015) studied electronic mind maps in English reading comprehension among ninth-grade students in schools in Irbid, Northern Jordan. Two intact classes participated in the study. The experimental group comprised 30 learners taught through electronic mind maps, while the comparison class learned through the traditional approach. Data were obtained through a reading-comprehension test and analyzed statistically after the instructional period. The post-test means differed significantly at the 0.05 level in favor of the experimental group. The researchers also reported a medium effect size for the use of electronic mind maps in reading comprehension. The findings, therefore, suggested that the visual electronic mapping approach produced a meaningful improvement in students' ability to understand the English reading material.

Buran and Filyukov (2015) applied mind mapping in an English course in higher education and reported that most students preferred using maps to understand information rather than relying only on continuous text. Participants also identified benefits for problem solving, brainstorming, vocabulary learning, and note-taking, which were associated with improved reading comprehension. Malekzadeh and Bayat (2015) and Parikh (2016) likewise compared experimental and control groups and reported stronger reading-comprehension performance among learners taught through mind mapping. The strategy appeared particularly useful for helping students infer information that was not stated explicitly in the text.

In his study, Elshahrany (2010) examined the applications of an electronic map in the teaching of a unit on 'Islam in Africa' to 50 second-grade intermediate students. The study adopted quasi-experimental approach where one group studied the unit based on electronic maps and the other studied the unit based on the traditional method in the second semester during 2009/2010. Post-test means favored the experimental group, and the attitude measure likewise showed better post-intervention responses among students who had used the electronic maps. On the basis of these findings, the study recommended wider application of e-learning methods in geography, development of teachers' competence in using the tools, and incorporation of such approaches into teacher-preparation programmes. Elqasemia (2010) examined mind mapping in science among 103 third-grade basic-education learners at Manart Alelm School in Northern Elbatanah, Oman. The experimental group comprised 52 students taught with mind maps, while 51 students in the control group learned through the conventional approach. The study prepared a teacher guide and student notebook and

used an achievement test constructed around Bloom's levels of memorization, understanding, and application together with a measure of basic scientific processes. Cronbach's alpha coefficients of 0.83 and 0.85 were reported for the instruments. The results did not show significant experimental-control differences in overall post-achievement scores or in most of the assessed scientific-process skills, including observation, classification, communication, measurement, prediction, inference, induction, conclusion, and use of numbers. However, significant differences were reported for the use of spatial and temporal relationships in favor of the experimental group. The overall effect of mind mapping on achievement and the development of basic scientific processes was described as moderate. The study therefore recommended workshops that would familiarize science teachers with the educational uses of mind maps and provide practical guidance on how the strategy could be implemented in teaching.

The reviewed literature shows that mind mapping has been used as an instructional strategy to support memory, organization of ideas, and comprehension. Its non-linear structure allows related parts of a map to be linked and cross-referenced easily (Linlin, Yang, & Liu, 2019). However, a large proportion of the reviewed studies involved university or college students, and many were conducted in other subject areas other than Kiswahili. For example, Keter *et al.* (2021) examined mathematics learning in Nandi County and reported positive outcomes, while studies in Science and English also linked mind mapping with improved learning. Research in subjects such as History and Islamic Religious Education has further associated the strategy with attention and motivation. These contexts differ from secondary-school Kiswahili comprehension, which creates a need for subject-specific evidence.

Some learners can read a Kiswahili text accurately yet still lack effective strategies for organizing and interpreting what they have read. Although mind mapping has been examined in several educational settings, relatively little published work has focused specifically on its use for developing Kiswahili comprehension, particularly among learners who experience comprehension difficulties (Cartwright, 2011). This gap provided the basis for the present study, which examined the effectiveness of mind mapping in developing Kiswahili comprehension skills.

III. METHODOLOGY

3.1 Research Design

This study adopted the Solomon-Four Group Quasi-experimental research design that uses naturally assembled groups such as classes in research as shown in Figure 1 below. The research design involved a random assignment of participants to four schools which served as experimental group and control group and involved the use of pretest and posttest. The pretest was administered for both experimental and control group.

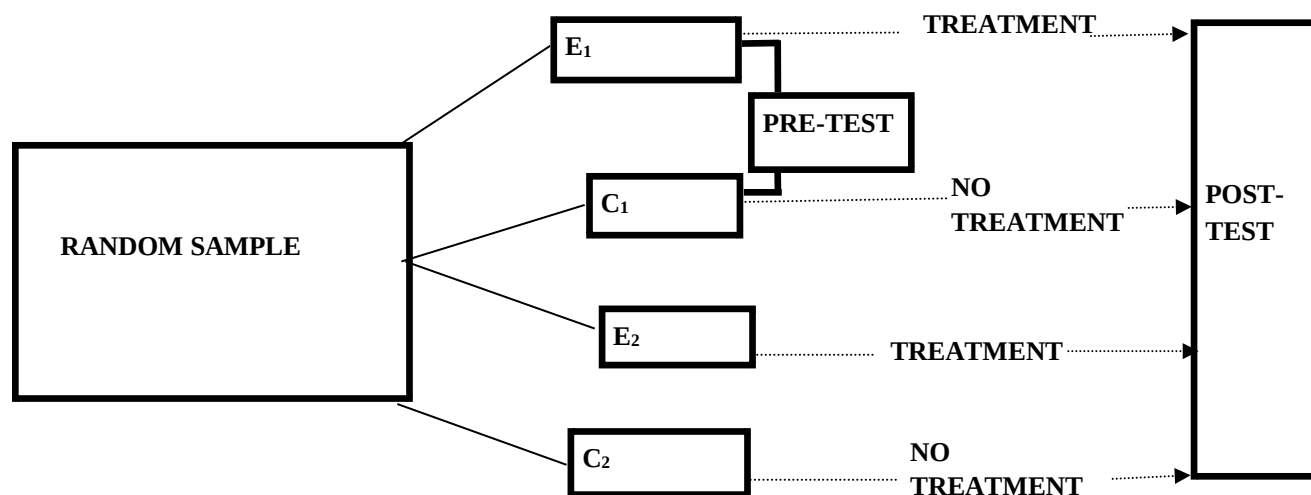


Figure 1

Showing Solomon-Four Experimental Research Design

E₁ -Experimental Group 1

C₁- Control Group 1

E₂- Experimental Group 2

C₂- Control Group 2

3.2 Study Area

The study was carried out in Kakamega North Sub-county, where low achievement in Kiswahili reflects a challenge also observed in other parts of the country. Kakamega North is one of the thirteen sub-counties in Kakamega County and had a population of 205,166 according to KNBS (2009).

3.3 Target Population

The target population was form three students with a sample size of 205 from Kakamega North Subcounty, Kakamega Kenya. The subcounty had 5800 form three students (SDOE, 2024). The total number of target population was 205 students. The form three students were suitable for the study because by this time they are expected to have good comprehension ability.

3.4 Sampling and Sample Size

The study purposively selected public mixed sub-county schools which have similar characteristics in terms of resources to participate in the study. The sample size was determined by Krejcie and Morgan (1970) formula. Using Sampling table population of 400 gives sample size of 201 respondents. The selection of schools and assignment of one form three stream per school selected to either experimental or control groups was done by balloting. A pilot study was conducted in selected schools in Kakamega North subcounty using split half method. The test was assigned to one form three stream per school selected to either experimental or control groups through by balloting. The tool was administered and re-administered at an interval of two weeks. There were three items which were removed and this improved the Cronbach's Alpha from 0.63 to 0.82, meaning the tool was reliable for data collection.

3.5 Data Collection Instrument and Procedure

Data was collected using pretest and posttest. The reading test was used to know the students' reading comprehension skills. A pretest was administered before treatment period to E₁ and C₁. The application of the mind mapping strategy and creating of mind maps was taught to the participants of the experimental group. After three weeks of treatment, a post test immediately administered to all the four groups. The purpose of the posttest was to investigate if there was any difference in students' score in Kiswahili Achievement Test when taught using the mind mapping strategy and the conventional methods of teaching.

3.6 Data Analysis

The data collected were analyzed using descriptive and inferential statistics. Achievement test scores data were presented in means, standard deviations and percentages to summarize the data, and to describe the pattern of responses across the groups. Student t-test was then used with a Level of significance set at 0.05 to test the hypotheses of this study and ascertain the statistical significance of the mean differences observed. Instructional method (mind mapping and conventional instruction) was the principal independent variable, while comprehension skills and test scores were the dependent outcomes. If two relevant means were compared, t-tests were used to obtain mean scores for E₁, E₂, C₁ and C₂. When it was necessary to do comparisons involving the four instructional groups, one-way analysis of variance (ANOVA) was used. Dunnett T3 post hoc tests were used to identify which pairs of groups differed, where this assumption was not met and the omnibus test showed that there were between-group differences. The pairwise analysis also showed the direction and magnitude of the mean differences so that the experimental and control conditions could be interpreted accurately. Quantitative analyses were performed using SPSS version 28, with all statistical tests evaluated at $\alpha = 0.05$. A result with a probability value below this threshold was treated as statistically significant for purposes of testing the relevant null hypothesis.

3.7 Ethical Consideration

The study observed ethical principles relating to confidentiality, privacy, anonymity, voluntary participation, and informed consent (Kombo & Tromp, 2006). Approval of the research proposal was sought from the School of Graduate Studies at Masinde Muliro University of Science and Technology (MMUST) and the University Senate. Authorization for data collection was also obtained from National Commission of Science, Technology and Innovation (NACOSTI) and the relevant school administrations. Further permission was sought through the Ministry of Education using an introductory letter from Masinde Muliro University of Science and Technology. Because the participants were minors, the purpose of the study and the requirements for participation were explained before consent procedures were completed.

Information supplied by participants was handled confidentially and respondents' identities were protected (Mugenda & Mugenda, 1999). Completed hard-copy materials were stored in a locked cabinet, while electronic files were kept on a password-protected computer. Participation was voluntary, and students were not compelled to provide information. A report of the study findings was later shared with the participating schools. Anonymity was maintained by avoiding the use of participant or school names in the research report. Personal information was kept confidential,

and respondents were informed that the data collected would be used only for research purposes. The reporting procedures were therefore designed to prevent identification of individual participants.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 The Results of Pretest

To achieve this objective, the students who participated in the study were grouped into experimental and control groups. Experimental group students were taught using mind mapping strategy while control group was taught same content using conventional methods. Initially, pretest was administered to experimental group 1 and control group 1. However, results of pretest were not released to the students so as to ensure that the outcomes of pretest did not compromise the outcomes of the posttest. The pretest was administered to establish the current status of students comprehension skills. Both groups showed similar pretest results which indicated that the comprehension skills in Kiswahili of the students in experimental and control group was homogeneous. The means and standard deviations of the pretest were calculated and the results presented in Table. 2.

Table 2

Independent Sample T-test Results for Pretest between the Experimental and Control groups

Variable	E ₁		C ₁		t (100)	P	Cohen's d
	M	S.D	M	S. D			
PRETEST	45.18	12.61	44.76	12.83	.165	0.869	.0033

Table 2 shows that students in experimental group had a mean of 45.18 with a standard deviation of 12.61, while those in the control group had a mean of score of 44.76 with a standard deviation of 12.83. The results shows that there is no significant difference in scores of students between experimental and control groups for the pretest scores since the p-values were greater than 0.05. This shows that before treatment, the comprehension skill level between the two groups was similar. The two mean scores differed by less than one point and both corresponded approximately to a C-level, indicating very similar initial achievement. This pattern was broadly consistent with the five-year Kiswahili performance trend for Kakamega North Sub-county, which produced an average mean score of about 5.0678, equivalent to C-. Although the Kenya Certificate of Secondary Education (KCSE) and Kiswahili Achievement Test (KAT) scores were obtained on different scales, both sets of results pointed to generally modest comprehension performance in the local context. The similarity of E₁ and C₁ at pre-test indicated that the two groups began the study with comparable levels of background comprehension. This baseline comparison was important because it reduced the likelihood that any later difference between the two pretested groups could simply be explained by a large pre-existing achievement gap. Consequently, subsequent post-test differences could be interpreted in relation to the instructional conditions while still recognizing the limits of a school-based quasi-experiment.

Because the pre-test p-value exceeded the 0.05 significance level, the results indicated no statistically significant baseline difference between the experimental and control groups. Their mean scores and variability were also closely comparable, which supported the conclusion that E₁ and C₁ entered the treatment period with similar levels of Kiswahili comprehension. This finding is consistent with Mahasneh (2017), who likewise reported no significant pre-test difference between experimental and control groups when an independent-samples t-test was applied. Khodabandeh (2021) also found comparable pre-intervention performance among groups in a study of a mind-mapping-based flipped-learning approach. The agreement between these studies and the present baseline results is methodologically important because intervention effects are easier to interpret when the groups do not differ substantially before treatment. The pre-test therefore served not only as a measure of current comprehension but also as evidence supporting the comparability of the pretested conditions. The study findings were found to be similar to those of Elqasemia (2010) which found out that there were no significant differences between the control and experimental groups in the achievement of test scores in pretest when subjected to independent sample t-test.

4.1.2 The Effect of Mind Mapping on Students' Comprehension Skills in Kiswahili

H₀: There is no statistically significant difference between the use of mind mapping and development of comprehension skills in Kiswahili among students in Kakamega North Sub-county.

A one-way analysis of variance (ANOVA) was conducted to compare post-test achievement across the four groups and evaluate the null hypothesis.

Table 3*ANOVA Table for Differences in Kiswahili Achievement Test (KAT) Post-test Score across Schools*

		Sum of Squares	df	Mean Square	F	Sig.
POSTTEST * GROUP	Between Groups (Combined)	11893.92	3	3964.639	31.255	.0
	Within Groups	25496.85	201	126.85		
	Total	37390.76	204			

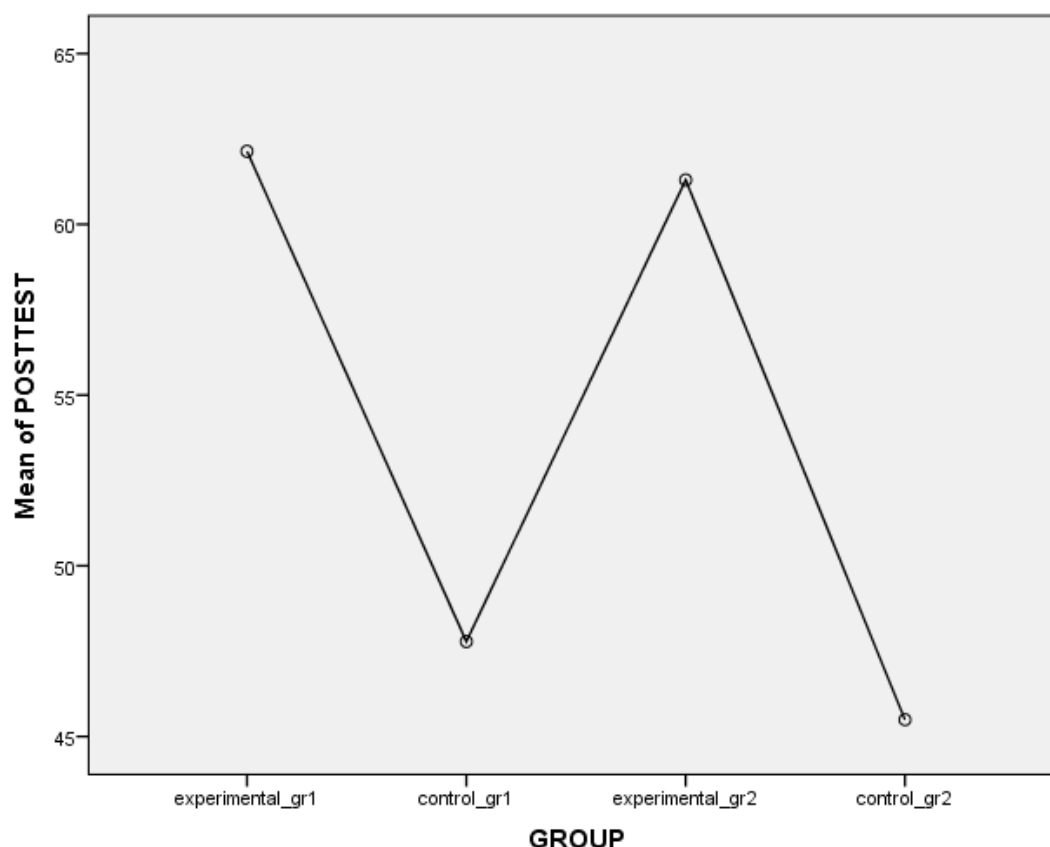
The ANOVA indicated that post-test performance on the Kiswahili Achievement Test differed significantly across the four groups, $F(3, 201) = 31.26$, $p < .05$, $\eta^2 = .317$. Levene's test was significant, indicating that the assumption of equal variances was not satisfied. For this reason, subsequent pairwise comparisons were conducted using the Dunnett T3 procedure. Post hoc comparisons showed that performance differed significantly between the experimental and control conditions. E1 recorded significantly higher scores than the relevant control groups, and E2 also performed significantly better than the control conditions. The two experimental groups did not differ significantly from one another, indicating broadly comparable outcomes under the mind-mapping treatment. Similarly, the comparison between the control groups did not show a meaningful intervention-related difference. Taken together, the results support the conclusion that the instructional condition used in the experimental groups was associated with stronger Kiswahili comprehension performance. The descriptive and inferential results are summarized in Table 4.

Table 4*Means, Standard Deviations, and One-Way Analyses of Variance*

GROUPS	F(3, 201)						
	M	SD	Lavene's test statistics	Sig	F	Sig	η ²
E ₁	62.14	13.94	6.41	.000	31.26	.000	.318
C ₁	47.78	13.13					
E ₂	61.30	8.92					
C ₂	45.49	8.20					
GROUP DIFFERENCES	95% confidence level						
Groups	Mean.Diff		Sig	LB		UB	
E ₁ -C ₁	14.36		0.000	7.09		21.63	
E ₁ -C ₂	16.65		0.000	10.56		22.74	
E ₂ -C ₁	13.52		0.000	7.48		19.56	
E ₂ -C ₂	15.81		0.00	11.31		20.31	
E ₁ -E ₂	0.840		.999	-7.14		5.46	
C ₁ -C ₂	2.29		.870	-3.53		8.11	

* $p < .05$

At $\alpha = .05$, the ANOVA confirmed a statistically significant difference among the four group means, $F(3, 201) = 31.26$, $p < .05$, $\eta^2 = .318$. The effect-size estimate indicates that approximately 31.8% of the observed variation in post-test scores was associated with differences among the instructional groups. This represents a substantial proportion of the outcome variation within the context of the study. Pairwise results showed no significant difference between the two experimental groups and no significant difference between the two control groups, whereas the contrasts between experimental and control conditions were statistically significant. The pattern therefore shows consistency within the two types of instructional condition: the two mind-mapping groups performed similarly to one another, and the two conventional groups also showed comparable outcomes. Because the experimental means were higher, the second null hypothesis was rejected. The analysis consequently provided statistical evidence that the use of mind mapping was associated with better comprehension performance than the comparison approach.

**Figure 2**

A mean plot line Graph Showing the Differences between Experimental and Control groups

The two experimental groups produced comparable KAT means, and the two control groups also showed no significant difference from each other. However, the experimental-group means were substantially higher than those of the control groups, producing the overall pattern ($E_1 = E_2 > C_1 = C_2$). This pattern indicates that students taught through mind mapping achieved better comprehension outcomes than students taught through the conventional approach.

Furthermore, the results of the pretest and posttest conducted between the two groups were analyzed and their means and standard deviations are presented in Table 5

Table 5

Comparison of Pretest and Post-test Scores on KAT

		GROUPS			
SCALE	OVERALL	E ₁ (n=)	C ₁ (n=)	E ₂ (n=)	C ₂ (n=)
Pre- test	-	45.18	44.76		
SD	-	12.61	12.83		
Post- test	-	62.14	47.78	61.30	45.89
SD	-	13.94	13.13	8.92	8.20
Mean	-	62.14	61.3	44.76	47.78

E₁=Experimental group 1, C₁=Control group 1, E₂=Experimental group 2, C₂=Control group 2

Table 5 showing the comparison between the pre-test and post test scores across the groups. The average scores for experimental group 1 were higher ($M=62.14$, $S.D=13.94$) than Control group 1 ($M=44.76$, $S.D=12.84$) at posttest. Similarly, Control group 1 had higher scores ($M=47.78$, $S.D=13.13$) as compared to Control group 2 ($M=45.89$, $S.D=8.20$). The results in Table 2 show that, at the pre-test stage, the mean scores for the groups E₁ and C₁ had no significant difference, indicating that the learners had nearly the same initial ability before the intervention. This suggests that the groups were comparable at baseline and that any later differences would not be due to pre-existing achievement gaps. At the post-test stage, however, there was a noticeable increase in mean scores for the experimental groups. For instance, Group E₁ improved from a pre-test mean of 45.18 to a post-test mean of 62.14, while Group C₁ also showed substantial improvement. The differences in the mean scores between pre-test and post-test was for E₁ 16.96 while that for the C₁ was 3.02 and a mean difference of 14.36 was obtained in posttest results between the E₁ and C₁ groups.

Findings revealed that there is a statistically significant effect of the Mind Mapping instructional strategy on students in Kiswahili. The increase in post-test scores among the experimental groups indicates that the instructional intervention had a positive effect on students' performance in Kiswahili. The students taught Kiswahili with the mind mapping instructional strategy performed better than those taught by the conventional methods. In this case, the use of mind maps resulted to a difference of a mean score of 1 4.36. The relatively small changes in the experimental groups further strengthen the conclusion that the improvement was largely due to the treatment rather than normal progression. This may be due to the fact that mind mapping aroused their interest in learning their creative thinking and they were able to express themselves when using mind mapping. Similar results were obtained in the research carried out by Siriphanich *et al*, (2010). While the schools selected had similar characteristics with similar abilities, the expected results were to be similar. But the experimental groups outperformed the control groups after the intervention, suggesting that the strategy used was effective in enhancing achievement on the KAT. The improved performance of the experimental group may be attributed to the fact that mind mapping allows students to use an innovative form of note-taking to capture, develop and organize their maps (Tee *et al*, 2014). The strategy makes learning enjoyable, easier and fun for students to comprehend the read text. It also encourages them to think critically and deeply thereby generating new relevant ideas (Buzan, 2018).

Similar results were obtained in the research carried out by Comek *et al*, (2016) in Turkey which showed that the use of the mind mapping improved students' academic achievement in Science class. Besides researchers in Korea had shown that the use of mind mapping in science teaching improved junior high school students' creative thinking skills (Yoon & Kang, 2015). Efficiency of teaching with the use of mind mapping which was found to be higher or greater than the efficiency of conventional teaching approach. Besides that the students' involvement in the experimental group was also found to be higher than the one in the control group.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study was primarily concerned with the application of mind mapping strategy in Kiswahili in secondary schools. The study provided empirical data on the use of mind mapping in Kiswahili lessons gave an opportunity for students to be active learners by acquiring data, processing information, organizing details and constructing knowledge independently. According to the results from the tests, mind mapping is a learning tool that help students to comprehend much more effectively. It can be seen from the results of the hypothesis that the significance level is lower than alpha ($0.00 < 0.005$). In addition, mind mapping strategy also improves students' skills as well as their Kiswahili language ability.

5.2 Recommendations

The findings provide evidence that mind mapping can positively influence both comprehension achievement and learners' attitudes towards the instructional process. Kiswahili teachers should therefore consider incorporating the strategy as a brainstorming and text-organization tool when teaching reading comprehension. More broadly, teachers should continue to identify and apply innovative approaches that can strengthen students' reading and comprehension abilities. Kiswahili teachers should receive practical training on how to design and use mind maps when developing the different language skills. Curriculum implementation should create opportunities for the use of mind mapping and related learner-centred strategies so that teachers increasingly facilitate knowledge construction rather than rely only on direct transmission.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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