
EFFECT OF SCHOOL LEADERSHIP CULTURE ON LEARNER PERFORMANCE IN MATHEMATICS IN PUBLIC SECONDARY SCHOOLS IN NYANDARUA COUNTY, KENYA

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ABSTRACT

Leadership premised on collaboration, consultation and strategy may develop a culture that motivate learners and teachers to create an environment conducive for learning Mathematics in secondary schools. Low performance in Mathematics may likely limit career options, diminishing individual chances of meaningful contribution in the wider society and this study addressed collaborative, consultative and strategic leadership approaches as determinants of learner performance in Mathematics at KCSE.

This study adopted invitational theory by William Watson Purkey and Betty Siegel in 1978, emphasized that learning is enhanced when learners are positively encouraged or 'invited' into the school culture that recognizes inbuilt human values, responsibilities and capabilities that intentionally summons stakeholders to exploit boundless individual potential for better performance in Mathematics. The philosophical foundation of this study stems from positivist and constructivist epistemology that considers observable and perceived evidence as forms of

scientific findings in generating sound evidence.

*This informed adoption of **ex-post facto** research and study sought information using questionnaires and interview schedules from 76 Mathematics and 15 principals respectively. Findings of the study established that school leadership styles play a significant role in predicting learner performance, with strategic leadership ($p\text{-value} = 0.016$) emerging as the most significant factor in enhancing learner performance in Mathematics. The study recommends the MOE to strengthen policy on strategic leadership training for principals and that research opportunities may target exploring effects of collaborative and consultative leadership approaches on teaching-learning in Mathematics.*

Key Words: *Leadership Styles, Performance in Mathematics, School Culture.*

INTRODUCTION

Leadership may create a positive culture through management practices and administrative roles as an effective process in preparing learners for the

future through better performance in Mathematics. Leadership premised on collaboration, consultation and strategy may develop a culture that motivate learners and teachers to create an environment conducive for learning Mathematics. Bayar and Karaduman (2021) added that principals have a role in promoting a positive culture by creating a common vision and encouraging cooperation through a participatory leadership approaches to enhance performance in Mathematics. In supporting this argument, Yagci and Uluoz (2017) argued that an inclusive approach that is transcending beyond a single leader approach and inclining towards collaborative, consultative and strategic decision-making would enhance teamwork to accelerate learning Mathematics. A secondary school leadership premised on structured consultation may create an interactive and inviting culture cultivating trust and attractiveness for better learner attainment in Mathematics. In addition, Niemi & Jahnukainen (2020) argued that principals who inappropriately regularized consultation and reporting mechanism, realized diminished scores in Mathematics.

Effective learning requires a nourishing school culture which is fulfilling, captivating and competitive to stimulate learners' interest. In the same vein, Raudys (2018) indicated that manifestation of an ineffective instructional environment may dissuade learners from participating in learning activities resulting in nonchalant attitude towards Mathematics in secondary schools.

As noted by Escalona (2019), a secondary school principal as leader should build a culture that is influence teacher's efforts in instructional management to improve performance in Mathematics. Secondary school leadership focusing on development of positive culture in secondary schools as an environment tends to boost learning performance across subject areas. Yagci and Uluoz (2017) documenting on the leadership styles of school administrators in Cyprus argued that institutional principals may create a positive culture through both management practices and administrative roles as an effective process in preparing learners for the future through better performance in Mathematics. Further, Bayar and Karaduman (2021) asserted that leadership keen on positive school culture could be collaborative, consultative and strategic with a strong emphasis on learning goals and high expectations on learner performance in different subject areas across school system

Leadership incorporating collaborations and sharing tend to make the school atmosphere more comfortable and motivating to learners during Mathematics instructions. Escalona (2019) in congruent asserted that collaborative leadership in secondary schools is about the establishment of shared purpose as a basic stimulant towards improving learner performance across subject areas including Mathematics. The focus of this study was on specific practices of teaming and team work as way of steering staff and learners towards building a shared vision, fostering the acceptance of institutional goals and demonstrating higher learning performance expectations in Mathematics.

As Raudys (2018) posits, secondary schools teaching and non-teaching staff in a teaming approach should work together in order to accomplish pre-determined instructional targets in Mathematics. This is in tandem with formal learning techniques and activities which are critical in enhancing learner performance in Mathematics as suggested by Yagci and Uluoz (2017). In practice, collaborative instructional leadership may encourage learners to be active in class through creation of a conducive learning environment necessitated by a positive school culture.

Delegation of authority with enhanced teamwork may help secondary school leadership achieve targeted strategic objectives that improve performance in Mathematics by bringing together individual energies and creating synergy. More still, Huber et al (2017) argued principals and secondary schools' community in entirety need to collaboratively function by shifting spotlight from leadership as an assurance that everyone get credit they deserve. To enhance teamwork secondary school principals, staff and learners should collaboratively function by creating commonality of purpose and interdependence by relying on each other as they work towards better performance in Mathematics. In working groups members meet to share information, discuss ongoing project and make decisions, but do not produce anything collectively and are judged on individual efforts (Pietsch & Tulowitzki, 2017). Teamwork in secondary schools may lead to success because it involves communication, effective co-ordination and division of workload among all teaching and non-teaching staff members. In concurrence, Christ and Dobbins (2016) added that teamwork consists of time, resources and commitment towards building effective communication, sense of belonging or being part of institutional culture purposely for better learner performance.

To create a positive school culture, principals need to ensure that staff works as one team through delegation of duties toward better learning attainment in Mathematics.

Consultative Leadership and Learner Performance in Mathematics

Secondary school principals may create an interactive and inviting culture premised on structured engagement built on trust and attractiveness for better learner attainment in Mathematics. consultative approach to leadership is central to institutional turnaround for accelerated learner performance in Mathematics that Pietsch and Tulowitzki (2017) observed that may entail restructuring instructional management and setting the stage for new cultural norms towards improved learner performance in Mathematics.

A consultative reporting mechanism is vital in instructional management across secondary schools to enhance learning in Mathematics. As noted by Bantwini (2020), a paradigm shift has emerged creating the need for strategic focusing and visioning with a sense of adaptability and flexibility in instructional leadership in secondary schools. Therefore, a secondary school principal in the twenty-first century will inevitably need to keep the high-level goal in sight while at the same time able to track day to day instructional activities in a consultative reporting mechanism to enhance learning in Mathematics. Echoing Bantwini (2020) on the paradigm shift, Sakiz *et al.* (2012) added that the twenty-first century secondary school principal leadership approach calls for disregard for the top-

down hard-nosed direction in preference to flexibility and empathy through structured engagement.

Secondary school principals are expected to manage respective institutions as well as provide leadership as mentors, facilitators and visionaries through structural engagement to stimulate creativity, innovation and promote learning Mathematics. As noted by Chen *et al.* (2020), the main focus of this consultative approach in leadership through structural engagement is to pursue learning activities for improving and enhancing performance in Mathematics. The critical challenge of consultative approach in leadership through structural engagement as opined by Escalona (2019) is for secondary school principals to explore appropriate tools and approaches capable of uplifting fragmented activities towards more integrated efforts.

Such tools would be critical in reporting and allowing secondary schools in Nyandarua County and elsewhere to communicate performance, strategies being pursued and steering goals towards better learning outcomes in Mathematics. With effective structural engagement and reporting mechanism is possible to establish a process of integrating existing activities and developing these further in a more consultative approach towards a positive school culture. Further, Christ and Dobbins (2016) noted that with several elaborated assessment and reporting schemes and systems in place secondary schools may analyze performance, discover potential for improvement and help derive

further measures in enhancing learning attainment in Mathematics.

Strategic Leadership and Learner Performance in Mathematics

The demand for more accountability in the education system strengthens the view that strategic leadership is important to creating a positive instructional environment. Mahdi and Almasfir (2014) viewed strategic leadership to have a policy orientation that guides decisions and actions as a base for formulation and implementation of plans designed to enhance learning across subject areas. In addition, Prasertcharoensuk and Tang (2017) asserted that strategic leadership involve creation of comparative advantage through policy orientation are key elements of a positive institutional culture. To enhance learning in Mathematics, secondary school leadership need to create a positive institutional culture by target setting and strategic development planning. More still, Bayar and Karaduman (2021) noted that secondary school principals should adopt strategic leadership as a way of enabling a culture that responds to attainment of desired learning outcomes in Mathematics. Ideally, the desire to have an inviting and positive school culture has emerged creating the need for strategic focusing and visioning with a sense of adaptability and flexibility towards teaching and learning Mathematics.

Further, Pietsch and Tulowitzki (2017) viewed strategic desire as a set of decisions and actions that result in the formulation, implementation, and control of plans designed to enhance learner

performance in Mathematics in drive innovation and economic development.

Adoption of effective and efficient consultative reporting mechanism may strengthen learning management processes in Mathematics as noted by Damcho and Reeta (2023) assertion that less hierarchical and strategic leadership creates a positive school culture encourage better performance in Mathematics. More still, to achieve a comparative advantage in learning Mathematics, strategic school's leadership need to focus on critical resources which may make a difference and provide an assurance of sustained future performance. In addition, Prasertcharoensuk and Tang (2017) stated that not all institutional resources hold the potential of providing a comparative advantage unless they possess four attributes: rareness, value, inability to be imitated, and inability to be substituted in the efforts of improving performance in Mathematics. Therefore, policy orientation in secondary schools' efforts towards creating a positive culture to enhance performance in Mathematics should be about gaining access to key resources and building great teams. Through strategic leadership, secondary schools in Nyandarua could manage institutional portfolio of resources by organizing them into capabilities, structuring management to use the capabilities, and developing and implementing a strategy to leverage those resources to achieve a comparative advantage as far as performance in Mathematics is concerned.

STATEMENT OF THE PROBLEM

High performance in Mathematics may facilitate wider career opportunities for gainful participation in national development. However, low performance in Mathematics may likely limit career options, diminishing individual chances of meaningful contribution in the wider society. Drawing from this, Nyandarua County has faced persistent low performance in Mathematics at KCSE across public secondary schools between 2018 and 2022, which is manifested by mean scores ranging from 3.2 to 3.8 against Kiambu (mean 4.4), Murang'a (mean 5.2) and Nyeri (mean 4.8). Further, Nyandarua County registered above 80 percent of public secondary schools with a mean score less than 3.5 in Mathematics over the same period (Nyandarua County Department of Education, 2021). Further, Kamau (2020) linked low learner performance in Mathematics to inadequate teaching force, low learner engagement, entry behaviour, inappropriate assessment techniques and inflexible teaching methods. Against this background, the study sought to examine effect of school culture on learner performance in Mathematics in Nyandarua County, Kenya.

PURPOSE AND HYPOTHESIS OF THE STUDY

The purpose of the study sought to examine effect of school leadership on learner performance in Mathematics in public secondary schools in Nyandarua County, Kenya. The study addressed collaborative, consultative and strategic leadership approaches as determinants of learner performance in Mathematics at KCSE.

The following null hypothesis was adopted:

Ho1. There is no statistically significant relationship between school leadership and learner performance in Mathematics in public secondary schools in Nyandarua County, Kenya,"

THEORETICAL FRAMEWORK

This study adopted invitational theory by William Watson Purkey and Betty Siegel in 1978, emphasized that learning is enhanced when learners are positively encouraged or 'invited' into the school culture that recognizes inbuilt human values, responsibilities and capabilities that intentionally summons stakeholders to exploit boundless individual potential for better performance in Mathematics (Purkey and Siegel, 1978). According to Purkey (1992) invitational theory is premised on four dimensions namely: personally, inviting with oneself; personally, inviting with others; professionally inviting with oneself; and professionally inviting with others constitute positive school culture for improved performance across specializations.

Invitational theory emphasize autonomy, positive relationships, and the value of perception, as key constructs for learning and achievement, given humans have basic psychological needs for autonomy, relatedness, and competence. Invitational theory argue that invitational pedagogy constructed on four principles of respect for people, trust, optimism and intentionality, may facilitate an inviting school culture for enhanced interest in teaching and learning of Mathematics.

Additionally, inviting school culture may address the psycho geography and the constructive alignment of learning environments and the training of teachers for effective learner performance across subjects (Damcho & Reeta 2023).

METHODOLOGY

The philosophical foundation of this study stems from positivist and constructivist epistemology that considers observable and perceived evidence as forms of scientific findings in generating sound evidence. According to Park et al (2020) positivist focuses on verifying theories while ontologically is based in the assumption that a single tangible reality that exists may be understood, identified, and measured to establish cause-effect relationship between phenomena; and in this case the influence of school leadership on learner performance in Mathematics in Nyandarua county. This informed adoption of *ex-post facto* research design to provide a statistical measure on the influence of secondary school leadership on learner performance in Mathematics in Nyandarua County. The study sought information from Mathematics teachers as well as the principals in public secondary schools within Nyandarua County.

The study employed a combination of systematic, purposive, and random sampling techniques to select a sample from target population of 341 made up of, 236 Mathematics teachers and principals in 105 public secondary schools.

The study estimated the number of mathematic teachers per school to be six resulting in sample of 90 Mathematics teachers from 15 secondary schools with the aim of providing comprehensive insights into the relationship between school leadership and learner performance in Mathematics. The study used questionnaires, interview schedules, observation schedules and documentary analysis to capture both quantitative and qualitative data.

RESULTS AND DISCUSSION

A secondary school leadership premised on structured consultation may create an interactive and inviting culture cultivating trust and attractiveness for better learner attainment in Mathematics. Findings from this study was obtained from 15 principals and 76 Mathematics teachers out of 90 sampled and starting with demographic analysis the focus was on learner performance in Mathematics between 2018 and 2022, profiles of schools, principals, teachers and learners. Analysis of results indicate that out of the 15 sampled public secondary schools, 12 had an average KCSE score below a C+ in Mathematics accounting for 80% and suggesting that a significant majority of the sampled secondary schools in Nyandarua County are facing issues in raising quality of performance in the subject at KCSE. This is a confirmation of Watene (2021) findings that public secondary schools in Nyandarua have been performing dismally with over three quarters of learners scoring below C+ at KCSE. Additional analysis of the KCSE performance between 2018 and 2022 across sampled secondary schools in presented in Table 1.

Table 1: Five-Year Summary of KCSE Mathematics Performance in Nyandarua County

	Mean	SD	Median	Minimum	Maximum
Mean 2018	4.52	1.68	4.54	2.12	7.10
Mean 2019	4.52	2.33	3.51	1.63	8.94
Mean 2020	4.16	1.91	3.24	1.52	7.79
Mean 2021	3.82	2.01	3.23	1.69	8.22
Mean 2022	3.01	1.66	2.30	1.32	6.63

Table 1 results indicate that the mean score for Mathematics at KCSE have a relatively consistent central tendency over the five-year period, being around 4.52 in 2018, 4.52 in 2019, gradually decreasing to 3.01 in 2022. The decrease in performance in Mathematics from 2020 may be attributed to irregular instruction in schools during the Covid-19 pandemic period, which according to Areba (2020), may have contributed to uneven syllabus coverage in secondary schools in Kenya. More still, the standard deviation, which signifies the dispersion within the data, increased from 1.68 in 2018 to 2.33 in 2019, suggesting greater variability in 2019.

The Median value, which displayed the middle value in the dataset, reflected that the distribution was positively skewed (right tailed) between 2019 and 2022, with class median being less than the mean.

By implication, the results signified that majority of learners scored below the class mean, indicating majority learners performed poorly in the period of stud, with a few registering high scores (Bluman, 2012). Further, the lowest and highest values observed in the period between 2018 and 2022, recorded the lowest value of 1.32 and highest value as 8.22, indicating a wide spread of the data with occasional outliers. Consequently, the analysis showed learner performance in Mathematics in be relatively stable, but with varying levels of dispersion and central tendency over the five-year period.

Table 2 provided a retrospective analysis of overall school performance in Mathematics, focusing on school type and number of teachers.

Table 2: Public Secondary Schools' Demographics in Nyandarua County

Variables	Categories	n	%
School Type	BB	2	13
	GB	4	27
	BD	0	0
	GD	0	0
	MD	4	27
	MB	3	20
	MD&MB	2	13
	Total	15	100
Number of Teachers	Under 10	1	6.7
	Nov-20	5	33
	21-30	4	27
	31-40	3	20
	Over 40	2	13
	Total	15	100

In relation to type of school, the results indicated that majority were girls boarding (4, 26.7%) and mixed day (4, 26.7%) secondary schools. Additionally, the p-value was 0.554, indicating that institutional type and school performance in Mathematics were not statistically associated. However, none of the day schools featured in the high performing category, which underscore the relevance of boarding facilities in enhancing teacher-learner interaction as well school plant in positive performance outcomes.

This position is also supported by Hoeg and Bencze (2017) assertion that higher performance in Mathematics in enhanced contact-time between learners, instructional materials and teachers. Regarding the number of teachers in the school, most schools (5, 33,3%) had between 11 and 20 teachers, with two (13.3%) having more than 40 teachers. The p-value (0.035) revealed a statistical association between number of teachers and learner performance in Mathematics. The results signify that high number of teachers may enhance teacher-learner interaction and supervision of instructional management, which promotes a positive culture of as far learner performance in Mathematics is concerned. The results support Watene (2021) perspective that high number of teachers in a secondary school institution may likely improve learner performance across different subject specialties.

The study sought to offer insightful views of the relationship between various principal demographics and overall school performance in

Mathematics, as well as test for statistical association between the variables.

Table 3: Profile of Secondary School Principals

Variables	Categories	n	%
Gender	Male	11	78.6
	Female	4	11.4
Qualifications	Graduate	13	86.7
	Post Graduate	2	13.3
	Total	15	100
Experience Years	Under 5	2	14.3
	06-Oct	0	0
	Nov-15	0	0
	16-20	1	7.1
	Over 20	11	78.6
	Total	14	100
Years in This School	Under 5	7	46.7
	06-Oct	5	33.3
	Nov-15	2	13.3
	16-20	0	0
	Over 20	1	6.7
	Total	15	100

The results in Table 3 indicated that a significant majority of the principals had graduate level of education (13,87%) with only two (13%) having postgraduate qualifications. The results also generated a p-value of 0.448 which showed a lack of significant association between principal's academic qualifications and learner performance in Mathematics. By implication, the analysis revealed that academic qualification of the principal may not directly be attributed to influencing teachers and learners towards performance in Mathematics.

This finding was contrary to Mahdi and Almsafir (2014) argument that better qualified secondary school principals provide better guidance for teachers about cooperation and working together towards better learner performance in Mathematics.

The results in Table 3 show that majority of secondary school principals had over 20 years (11, 78.6%) while two (14.3%) had less than five years. Chi-square analysis generated a p-value of 0.571, which showed there was no statistical relationship between teaching experience in years and learner performance in Mathematics. The analysis revealed that the principals teaching experience may not have contributed to a culture of performance in Mathematics in the sampled schools. This analysis is contrary to Pietsch and Tulowitzki (2017) assertion that experience provide secondary school principals with ability to develop alternative ways of dealing with situations which would positively impact in performance in Mathematic. In terms of length of stay in the current institution, majority of 7 (46.7%) had less than five years, while five (33.3%) had between six and 10 years. The results indicate a high turnover of principals that may contribute to missed chances of developing a positive culture of performance in Mathematics. The associated p-value result was 0.678, indicating a lack of significant association between years of stay in the current school and culture of performance in Mathematics. These results are contrary to Prasertcharoensuk and Tang (2017) perspective that longer stay in an institution enables secondary school principals to work in teams because of increased collegiality and shared strength that would positively impact in learner performance in Mathematics.

The teachers' demographics included in the study were gender, qualification, age, employer, teaching experience, years spent in the school, and teaching subjects as shown in Table 4

Table 4: Profile of Mathematics Teachers

Variables	Categories	N	%
Gender	Male	58	76.3
	Female	18	23.7
	Total	76	100
Qualification	SI/Diploma	1	1.3
	Graduate	71	93.4
	Post Graduate	4	5.3
	Total	76	100
Age	Under 25	5	6.5
	25-34	44	57.1
	35-44	20	26
	45-55	6	7.8
	Over 55	2	2.6
	Total	77	100
Teaching Experience	Under 5	34	44.7
	6 to 10	26	34.2
	11 to 15	6	7.9
	16 to 20	3	3.9
	Over 20	6	7.9
	Total	76	100
Years in this School (years)	Under 5	50	64.9
	6 to 10	20	26
	11 to 15	5	6.5
	16 to 20	1	1.3
	Over 20	1	1.3
	Total	77	100

Table 4 results revealed that 58(76.3%) of Mathematics teachers were male while 18 (23.7%) were female. The p-value of 0.959 indicated that gender of the Mathematics teacher does not significantly contribute to learner performance in Mathematics. The results are tandem with Oyier *et al.* (2017) assertion that teachers' participation teaching Mathematics disregards gender.

Regarding teacher qualification in the sampled schools, majority were graduates (71, 93.4%) while four (5.3%) and only one (1.3%) had an SI/Diploma qualification. Additionally, the p-value results of 0.397 showed a lack of statistical correlation between teacher qualification and learner performance in Mathematics. The results reveal that teacher qualification may not directly contribute to learner performance in Mathematics. This finding is contrary to Mahdi and Almsafir (2014) argument that better qualified teachers of Mathematics provide better guidance for learners towards better learner performance in Mathematics.

With regard to age stratification, majority of Mathematics teachers in the sampled schools (44, 57.1%) had between 25 and 34 years of age, while 20 (26%) had between 35 and 44 years of age. In addition, the associated p-value of 0.061 revealed a lack association between teacher's age and learner performance in Mathematics. In terms of teaching experience, majority of the teachers in the sampled secondary schools had taught for less than five years (34, 44.7%) while 26 (34.2%) had teaching expertise of six to 10 years. The associated p-value of 0.268 showed there was no statistical relationship between teaching experience and learner performance in Mathematics. By implication, the study recognized that teachers professional experience did not have any effect on instrumentation of mathematical materials in performing and non-performing schools.

The results contradict the findings of Reddy (2019) who established a strong connection between teaching experience and learner performance in Mathematics.

Regarding teaching years in the current school, 50 (64.9%) of the teachers had taught for less than six years while only one (1.3%) had over 20 years stay in the school. The results portray secondary schools in Nyandarua to be dominated by young and less experienced Mathematics teachers. Further, the associated p-value of 0.888 indicated a lack of significant relationship between teachers' period of stay in the schools and learner performance in Mathematics. The results are in tandem with Prasertcharoensuk and Tang (2017) perspective that longer stay in an institution has no significance on teachers work towards improved learner performance in Mathematics.

Analysis specifically targeted collaborative leadership, consultative leadership and strategic leadership. In this case, the analysis of the effect of school leadership on learner performance in Mathematics was done to understand influence of administrative practices on academic outcomes within public secondary schools in Nyandarua County. Further, the analysis may provide insights into how the leadership styles affect administrative decisions and actions on learner performance in Mathematics. To achieve this, respondents from the sampled educational facilities were asked to rate their level of agreement with leadership statements on a scale of one to five, where one represented the lowest and five represented the highest degree of observation by the targeted

respondents. The analysis entailed descriptive statistics, bivariate statistics and inferential statistics.

Escalona (2019) asserted that secondary school leadership should build a culture that influence teacher's efforts in instructional management to improve performance in Mathematics. Such a leadership needs to focus on development of positive culture as an environment that tends to boost learning performance across subject areas in secondary schools. Table 5 presents the descriptive statistics on teachers' perceptions focusing relationship between secondary school leadership types including collaborative, consultative and strategic, and learner performance in Mathematics.

Table 5: Teacher Perception of School Leadership and Performance

	N	M	M	M	S	Ske	Ku
	n	i	a	ea	D	wn	rto
		n	x	n		ess	sis
The principal embraces teamwork towards activities focusing on improving learning outcomes in Mathematics.	7 6	1	5	4. 09	.9 7 5	-.82 0	.04 9
Giving out to teachers improving learning outcome in Mathematics is evidently being practiced.	7 6	1	5	3. 82	1. 1 2 8	-.65 6	-.3 06
There is a structured engagement as far as efforts to improve learning in Mathematics is concerned.	7 6	1	5	3. 76	.9 6 4	-.87 7	1.0 17

A clear channel in reporting issues concerning improving learning outcome in Mathematics exists.	7 6	1	5	3. 82	1. 0 4 2	-.92 6	.83 4
Focus on improving learning outcome in Mathematics by school leadership gives a comparative advantage for better results at KCSE	7 6	1	5	3. 88	1. 0 5 8	-.72 9	-.0 79
The schools have a policy on guiding teaching and learning Mathematics.	7 6	1	5	3. 89	.9 9 4	-.79 8	.42 8

The results indicate that the mean scores reveal that the teacher’s respondents generally view the principal as being a team player and supportive of teamwork for enhancing Mathematics learning outcomes (Mean = 4.09, SD=0.975). There is a noticeable practice of providing support was also evident on the extent secondary school principals delegate authority to teachers for the purpose of improving learning in Mathematics (Mean = 3.82, SD=1.128). The fact that teachers acknowledge principals to be supportive and easily delegate work to improve performance is indicative of collaborative leadership with a shared purpose to improve performance in Mathematics among secondary schools in Nyandarua County. These findings are in congruent with Escalona (2019) assertion that collaborative leadership in secondary schools is about the establishment of shared purpose as a basic stimulant towards improving learner performance in Mathematics. During conversation with the principal of a high performing school had this to say:

As Raudys (2018) posits, secondary schools teaching and non-teaching staff in a teaming approach should work together in order to accomplish pre-determined instructional targets in

Mathematics. Evidence of working through structured engagement was revealed when perception of teachers on secondary school leadership was positive (Mean = 3.76, SD= 0.964) towards efforts to enhance learning in Mathematics. Structured engagement is a manifestation of consultative leadership which according to Pietsch and Tulowitzki (2017) entails restructuring instructional management and setting the stage for new cultural norms towards improved performance in Mathematics.

Consultative approach in leadership was further confirmed when teachers agreed that a clear channel for reporting issues related to Mathematics learning improvement is practiced (Mean = 3.82, SD=1.042) in respective secondary schools in Nyandarua County. This echoes assertions of Bantwini (2020) and Sakiz *et al.* (2012) that a paradigm shift in the twenty-first century require secondary school principal leadership approach to disregard top-down hard-nosed direction in preference to flexibility and empathy through structured engagement.

Additionally, teachers believe that a focus on Mathematics learning by the school leadership contributes to better K.C.S.E results (Mean = 3.88, SD=1.058), and the school has a policy guiding Mathematics teaching and learning (Mean = 3.89, SD=0.994). Leadership having a clear focus on teaching and learning of Mathematics coupled with a guiding policy is strategic towards better academic performance.

Just like Mahdi and Almasfir (2014) viewed strategic leadership to have a policy orientation that guide decisions and actions as a base for formulation and implementation of plans designed to enhance learning in Mathematics in secondary schools. Ideally, the desire to have an inviting and positive school culture is emerging among secondary schools’ leadership in Nyandarua and is creating the need for strategic focusing and visioning with a sense of adaptability and flexibility towards teaching and learning Mathematics in secondary schools. During the interview and discussion with the principal in one of the schools, this was emphasized.

The standard deviations indicate varying degrees of agreement among respondents for each item, suggesting differing perspectives on the effectiveness and practices of secondary school leadership in Nyandarua County in the context of Mathematics education. The differing perspective calls for secondary schools in Nyandarua to create a comparative advantage in learning attainment in Mathematics, focusing on critical resources which are most likely to make a difference and provide an assurance of sustained future performance. This will be in line with Prasertcharoensuk and Tang (2017) assertion that all institutional resources provide a potential comparative advantage and can be utilized to give better scores in Mathematics in Nyandarua County. Otherwise, the skewness and kurtosis values indicate the distribution characteristics of the responses for each item. On “what comparative advantage does your school has towards improving learning outcome in

Mathematics at KCSE”? One principal from a performing school had this to say.

Perception on school leadership was measured using six and three perception statements for teachers and learners respectively, which the respondents were asked to indicate their frequency on the five-point ordinal scale, calibrated as “lowest”, “low”, “moderate”, “high”, and “highest”. Table 5 displays the number and percentage of responses falling under the different levels of school performance (Below C+ and C+ and above) and the responses to each statement for each level. The chi-square values indicate the statistical significance of the relationship between school leadership items and school performance, assessed using the p-value, where $p < 0.05$ indicates a significant relationship. Table 6 presents the results for teachers and learners respectively.

Table 6: Teacher Perception on School Leadership and Performance

Perceptio n Statement s	Respon se Categor ies	School average performance between 2018 and 2022						X ² , df, sig.
		Below C+ (n=58)		C+ and above (n=18)		Total (n=76)		
		n	%	n	%	N	%	
The principal embraces teamwork towards activities	Lowest	1	1.7	0	0.0	1	1.3	5.70, 4, 0.22
	Low	3	5.2	0	0.0	3	3.9	
	Moderat e	1 5	25. 9	2 1	11. 1	1 7	22. 4	
	High	1 7	29. 3	4 2	22. 2	2 1	27. 6	

focusing on improving learning outcomes in Mathematics.	Highest	2 1	36. 2	1 2	66. 7	3 3	43. 4	
Giving out roles to teachers improving learning outcome in Mathematics is evidently being practiced.	Lowest	3	5.2	0	0.0	3	3.9	11.4
	Low	6	10. 3	0	0.0	6	7.9	5, 4, 0.02
	Moderate	1 6	27. 6	4	22. 2	2 0	26. 3	2*
	High	1 8	31. 0	2	11. 1	2 0	26. 3	
	Highest	1 5	25. 9	1 2	66. 7	2 7	35. 5	
There is a structured engagement as far as efforts to improve learning in Mathematics are concerned .	Lowest	3	5.2	0	0.0	3	3.9	14.2
	Low	3	5.2	0	0.0	3	3.9	3, 4, 0.07
	Moderate	1 4	24. 1	5	27. 8	1 9	25. 0	*
	High	3 1	53. 4	4	22. 2	3 5	46. 1	
	Highest	7	12. 1	9	50. 0	1 6	21. 1	
A clear channel in reporting issues concerning improving learning outcome in Mathematics exists.	Lowest	4	6.9	0	0.0	4	5.3	7.02, 4, .135
	Low	2	3.4	0	0.0	2	2.6	
	Moderate	1 5	25. 9	4	22. 2	1 9	25. 0	
	High	2 5	43. 1	5	27. 8	3 0	39. 5	
	Highest	1 2	20. 7	9	50. 0	2 1	27. 6	
	Lowest	2	3.4	0	0.0	2	2.6	

Focus on improving learning outcome in Mathematics by school leadership gives a comparative advantage for better results at K.C.S.E.	Low	6	10. 3	0	0.0	6	7.9	15.0 2, 4, 0.00
	Moderate	1 7	29. 3	0	0.0	1 7	22. 4	5*
	High	1 9	32. 8	6	33. 3	2 5	32. 9	
	Highest	1 4	24. 1	1 2	66. 7	2 6	34. 2	
The school has a policy on guiding teaching and learning Mathematics.	Lowest	2	3.4	0	0.0	2	2.6	11.5 7, 4, 0.02 1*
	Low	3	5.2	1	5.6	4	5.3	
	Moderate	1 6	27. 6	1	5.6	1 7	22. 4	
	High	2 4	41. 4	5	27. 8	2 9	38. 2	
	Highest	1 2	20. 7	1 1	61. 1	2 3	30. 3	

Table 6 results indicate that the majority of teachers (54, 71%) reported that the principal embraced teamwork for activities focused on improving Mathematics learning. However, the p-value of 0.223 (95% CI) revealed a lack of significant correlation between teamwork and Mathematics improvement. Furthermore, 47 (61.5%) of the teachers strongly acknowledged that principals assigned roles to teachers to enhance Mathematics learning. The associated p-value was 0.022 (at 95% CI), indicating a statistical association between the decentralization of roles and learner performance in Mathematics.

The analysis suggests that collaborative leadership, particularly in the assignment of roles to teachers by the principal, positively impacted learner performance in Mathematics. This finding is consistent with Escalona (2019) who noted that collaborative practices, especially when principals delegated roles to improve Mathematics learning, were strongly correlated with higher academic performance in secondary schools.

Regarding consultative leadership, the majority of teachers (51, 67.2%) strongly acknowledged that there was structured engagement by the leadership to enhance Mathematics learning. The associated p-value of 0.07 indicated a significant relationship between structured arrangements and learner performance. These results suggest that principals who effectively consulted with teachers on the best approaches to teaching Mathematics were likely to improve learner performance. This analysis is corroborated by Escalona (2019), who observed that principals of higher-performing secondary schools may implement coordinated interventions to enhance learning outcomes in Mathematics.

Additionally, the majority of teachers (51, 67.1%) highly perceived clear reporting lines as beneficial for improving learner performance in Mathematics. However, the associated p-value of 0.135 indicated a lack of a significant relationship between clear reporting lines and learner performance. This result contradicts the findings of Simão *et al.* (2022), which realized that organized reporting channels between principals and teachers strengthen the role of teachers in classroom communication, feedback,

setting goals and allocation of resources, ultimately enhancing learner performance.

In relation to strategic leadership, the majority of teachers (51, 67.1%) expressed a strong belief that school leadership focused on enhancing learning outcomes in Mathematics was likely to improve learner performance. The associated p-value of 0.005 indicated a statistically significant relationship between a strategic focus on improving Mathematics learning and learner performance. This finding aligns with the conclusions drawn by Bayar and Karaduman (2021), who argued that adopting strategic leadership enabled a culture conducive to achieving desired learning outcomes in Mathematics. Similarly, a significant majority of teachers (52, 68.2%) acknowledged that schools with a policy guiding teaching and learning Mathematics were highly likely to improve learner performance. The associated p-value of 0.021 revealed a statistical association between strategic school policy and learner performance in Mathematics.

This analysis suggested that a well-defined policy guiding teaching practices may contribute to higher academic achievements, underscoring the significance of policy orientation in secondary schools' efforts to create a positive culture conducive to enhancing learner performance in Mathematics. These findings underscore the importance of effective leadership practices, teacher support, and clear policies in promoting a positive school culture towards improving learning

outcomes. The differences in perception between the two performance groups suggest that such practices might be more prevalent and influential in schools achieving higher academic success because of an inviting school leadership. Such schools could have developed a climate and culture that motivate both learners and teachers to create an appropriate learning environment (Simão *et al.*, 2022) with a strong emphasis on high expectations on learner performance in different subjects including Mathematics.

The study utilized linear regression to model the relationship between learner performance in Mathematics and dimension of school leadership, which was measured in terms of collaborative leadership, consultative leadership, and strategic leadership. The linear regression equation is represented as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon \quad (1)$$

Where β_0 represents the intercept (baseline learner performance), $\beta_1 X_1$, $\beta_2 X_2$, $\beta_3 X_3$ denote coefficients quantifying the impact of collaborative, consultative and strategic leadership attributes on learner performance in Mathematics, and ϵ denotes the error term accounting for unexplained variability.

The model summary results were presented in Table 7.

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.421 ^a	.177	.143	.39614
a. Predictors: (Constant), Strategic leadership, Consultative leadership, Collaborative leadership				

Table 7 indicate that the correlation coefficient (R) value of 0.421 was realized, indicating a moderate positive linear relationship between the independent variables (leadership styles) and the dependent variable (learner performance in Mathematics). This value of R suggests that as the leadership attributes, such as collaborative leadership, consultative leadership, and strategic leadership, increase, there is a tendency for learner performance in Mathematics in increase as well, albeit moderately. In addition, the coefficient of determination (R-squared) value was 0.177, which indicates that approximately 17.7% of the variance in learner performance in Mathematics may be explained by the independent variables, namely strategic leadership, consultative leadership, and collaborative leadership. Additionally, the analysis yielded the adjusted R-squared value of 0.143, which considers the number of predictors in the model, reflects a slight decrease compared to the R-squared value, indicating that the additional predictors have contributed marginally to the explanatory power of the model.

The standard error of the estimate (Std. Error) provides an estimate of the variability in the dependent variable that is not explained by the

independent variables, with a value of 0.39614 in this case.

The results of the ANOVA (Analysis of Variance) test are shown in table 7.

Table 8: ANOVA Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.438	3	.813	5.179	.003 ^b
	Residual	11.299	72	.157		
	Total	13.737	75			
a. Dependent Variable: Learner Performance						
b. Predictors: (Constant), Strategic leadership, Consultative leadership, Collaborative leadership						

Under the Regression section, the results show the sum of squares, which represents the variability in learner performance explained by the regression model, indicates that the model accounts for 2.438 units of variability in learner performance. This insight is complemented by the degrees of freedom, reflecting the number of predictors in the model—namely, strategic leadership, consultative leadership, and collaborative leadership, which stand at 3. Calculating the mean square provides an average measure of variability explained by each predictor, further elucidating the impact of leadership styles on learner performance. The F statistic, with a value of 5.179, underscores the significance of the regression model, indicating a substantial improvement in prediction compared to scenarios with no predictors.

Moving to the residual section, the sum of squares signifies the unexplained variability in learner performance not accounted for by the regression model.

With 72 degrees of freedom for the residuals, the mean square offers an average measure of this unexplained variability. Lastly, the total section amalgamates the total variability in learner performance, integrating both the explained and unexplained variability. The small p-value (Sig.) of 0.003 (denoted as "b") indicates that the observed improvement in learner performance is unlikely due to random chance, further reinforcing the importance of the predictors (strategic leadership, consultative leadership, and collaborative leadership) in influencing learner performance in Mathematics.

The results are presented in Table 9.

Table 9: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	.462	.219		2.109	.038
Collaborative leadership	.004	.091	.008	.040	.968
Consultative leadership	.001	.089	.001	.006	.995
Strategic leadership	.196	.079	.414	2.476	.016

a. Dependent Variable: Learner Performance

The results from Table 9 provided insights into the impact of each predictor variable Collaborative leadership, Consultative leadership, and Strategic leadership on the dependent variable of learner performance in Mathematics. Specifically, Collaborative leadership yielded an unstandardized coefficient (B) of 0.004, indicating a minimal effect on learner performance.

This suggested that for every one-unit increase in collaborative leadership, there was only a 0.004-unit increase in learner performance, holding other predictors constant. The standardized coefficient (Beta) of 0.008 further confirmed this minimal impact, indicating that collaborative leadership had a negligible influence on learner performance when expressed in standard deviation units. Additionally, the t-value of 0.040 and the associated p-value of 0.968 suggested that the coefficient for Collaborative leadership was not statistically significant; implying that changes in collaborative leadership did not significantly contribute to variations in learner performance.

Similarly, Consultative leadership also produced minimal effects on learner performance, with an unstandardized coefficient of 0.001 and a standardized coefficient of 0.001. These values indicated that a one-unit increase in consultative leadership corresponded to only a 0.001-unit increase in learner performance, regardless of other predictors. The t-value of 0.006 and the associated p-value of 0.995 reinforced the lack of statistical significance, suggesting that changes in consultative leadership did not significantly impact learner performance.

In contrast, Strategic leadership emerged as a significant predictor variable with a notable impact on learner performance. The unstandardized coefficient of 0.196 indicated that for every one-unit increase in strategic leadership, there was a 0.196-unit increase in learner performance, holding other predictors constant.

The standardized coefficient of 0.414 reinforced this significant influence, suggesting that strategic leadership played a substantial role in enhancing learner performance when expressed in standard deviation units. Additionally, the t-value of 2.476 and the associated p-value of 0.016 indicated statistical significance, underscoring the meaningful contribution of strategic leadership to variations in learner performance. As a consequence, the linear regression model may be summarized as:

$$\text{Learner Performance in Mathematics} = 0.462 + 0.004 (\text{Collaborative leadership}) + 0.001 (\text{Consultative leadership}) + 0.196 (\text{Strategic leadership}) + 0.338$$

Based on the analysis provided, the study's null hypothesis, stated as "*H₀₁. There is no statistically significant relationship between school leadership and learner performance in Mathematics in public secondary schools in Nyandarua County, Kenya,*" was rejected as untrue. This rejection occurred because strategic leadership was found to be significantly associated with learner performance in Mathematics at a 95% confidence interval. Therefore, the regression model offers evidence that school leadership styles play a significant role in predicting learner performance, with strategic leadership emerging as the most significant factor in enhancing learner performance in Mathematics.

CONCLUSION AND RECOMMENDATIONS

Results indicated that secondary school teachers in Nyandarua County generally perceived their principals as supportive of teamwork and collaborative efforts towards better learning outcomes in Mathematics. Additionally, the study unveiled a positive perception of consultative leadership among teachers, evidenced by structured engagement. However, the varying standard deviations among teachers underscored differing perspectives on the effectiveness of secondary school leadership practices in Nyandarua County, highlighting the need for schools to leverage their comparative advantages to ensure sustained performance in Mathematics education.

The bivariate analysis results suggested that collaborative leadership, particularly in the assignment of roles to teachers, positively influenced learner performance in Mathematics. Effective delegation of roles by principals was associated with higher academic performance in secondary schools. Consultative leadership, characterized by structured engagement and clear reporting lines, also showed a significant relationship with learner performance, although some aspects did not reach statistical significance. Strategic leadership, focusing on enhancing learning outcomes in Mathematics and implementing policies guiding teaching practices, was strongly correlated with improved learner performance.

The analysis underscored that effective leadership practices and clear policies may foster a positive school culture conducive to improved learning outcomes in Mathematics.

Additionally, high-performing schools appeared to exhibit more prevalent and influential leadership practices, potentially contributing to academic success by fostering a motivating learning environment with high expectations for learner performance. Regarding the impact of each predictor variable, Collaborative leadership and Consultative leadership were found to have minimal effects on learner performance, with negligible unstandardized coefficients and non-significant p-values. In contrast, Strategic leadership emerged as a significant predictor variable, with notable effects on learner performance.

B. A substantial unstandardized coefficient indicated a considerable increase in learner performance associated with Strategic leadership, with a statistically significant p-value reinforcing its meaningful contribution to variations in learner performance. As a consequence, the study's null hypothesis, stating that there is no statistically significant relationship between school leadership and learner performance in Mathematics, was rejected. The regression model provided evidence that school leadership styles, particularly strategic leadership, played a significant role in predicting learner performance, thereby highlighting the importance of strategic leadership in enhancing learner performance in Mathematics in public

REFERENCES

1. Areba G N (2020): COVID-19 Pandemic impact on Kenyan education sector: Learner challenges and mitigations.

2. Bantwini, B. (2020). Congruence between pedagogical and assessment approaches: A case of One Large Province in South Africa. In H. Flavian (Ed.), *From pedagogy to quality assurance in education: An international perspective* (1st ed.), (pp. 87-99). Emerald Publishing Limited
3. Bayar, A., & Karaduman, H. A. (2021). The Effects of school culture on students academic achievements. *Shanlax International Journal of Education*, 9(3), 99-109.
4. Bluman A. G. (2012). *Elementary statistics. A step-by-step approach* 8th Edition. Mac Graw-Hill New York
5. Chen, D., Ning, B., & Bos, W. (2020). Relationship between principal leadership and students' Mathematics achievement: A comparative study between Germany and Chinese Taipei. *Asia Pacific Journal of Education*, 42(2), 228-244.
6. Christ, C., & Dobbins, M. (2016). Increasing school autonomy in Western Europe: A comparative analysis of its causes and forms. *European Societies*, 18(4), 359–388. <https://doi.org/10.1080/14616696.2016.1172716>
7. Damcho G. and Reeta R. (2023): Academic Performance in stem subjects among secondary boarding and day students in Lhuentse. *International Journal of Instruction* April 2023, Vol.16, No.2
8. Escalona, D. (2019). *Your voice: Culture is not static and unchanging, let's celebrate that*. Chicago Tribune.
9. Hoeg, D. G., & Bencze, J. L. (2017). Values underpinning STEM education in the USA: An analysis of the Next Generation Science Standards. *Science Education*, 101(2), 278-301.
10. Kamau, F. (2020). Factors contributing to poor performance in mathematics by students. A case study of Ndemi Secondary Schools in Kipipiri Subcounty, Nyandarua County.
11. Mahdi, O. R. and Almsafir, M. K. (2014). The role of strategic leadership in building sustainable competitive advantage in the academic environment. *Procedia - Social and Behavioral Sciences*, 129, 289-296. <https://doi.org/10.1016/j.sbspro.2014.03.679>
12. Niemi, A. M., & Jahnukainen, M. (2020). Educating self-governing learners and employees: Studying, learning and pedagogical practices in the context of vocational education and its reform. *Journal of Youth Studies*, 23(9), 1143-1160.
13. Pietsch, M., & Tulowitzki, P. (2017). Disentangling school leadership and its ties to instructional practices – An empirical comparison of various leadership styles. *School Effectiveness and School Improvement*, 48(1), 1–21.
14. Prasertcharoensuk, T., & Tang, K. N. (2017). The effect of strategic leadership factors of administrators on school effectiveness under the Office of Maha Sarakham Primary Educational Service Area 3. *Kasetsart Journal of Social Sciences*, 35(3), 316-323. <https://doi.org/10.1016/j.kjss.2016.09.001>
15. Purkey, W.W. (2022). An introduction to invitational theory. *Journal of Invitational Theory and Practice*.
16. Raudys, J. (2018). 11 real ways to build a positive school culture. Retrieved from <https://www.prodigygame.com/blog/school-culture/>.
17. Sakiz, G., Pape, S. J., & Hoy, A. W. (2012). Does perceived teacher affective support matter for middle school students in Mathematics classrooms? *Journal of School Psychology*, 50(2), 235-255. <https://doi.org/10.1016/j.jsp.2011.10.005>
18. Simão D, Costa N, Lopes B, and Agostinho S (2022): Learning Assessment in Angola: A study centred on students' voice. *Journal of Education*, 2022 / Vol. 12. No. 1
19. Watene, D. N. A. A. (2021). Perceptions of education stakeholders regarding influence of principals' strategic leadership practices on performance in Kenya Certificate Of Secondary Education Examinations in Public Secondary Schools, Nyandarua County, Kenya.
20. Yağcı, E., & Uluöz, T. (2017). Leadership styles of school administrators and its relation with the mobbing experience levels of social, science and mathematics teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(1), 155-166.
21. Park, Yoon Soo, Konge, Lars, & Artino Jr, Anthony R. (2020). The positivism paradigm of research. *Academic Medicine*,

95(5), 690–694 secondary schools in
Nyandarua County, Kenya.

The study recommends the MOE to strengthen policy on strategic leadership training through Kenya Education Management Institute (KEMI). Future research opportunities may target exploring effects of collaborative and consultative leadership approaches on inviting school culture for effective teaching-learning in Mathematics in Nyandarua County and beyond.