

Academic program diversity, unit costs and economies of scale in public secondary schools in Kenya

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ABSTRACT

Economies of scale are an economic phenomenon in economics of education that is used to justify expansion in school enrolment and management of school finances. The relationship between scale and efficiency becomes more complicated when schools are required to offer different academic programs and subjects, particularly academic programs that differ substantially in their staffing, infrastructure and instructional resource requirements. This study examined the relationship between academic program provision and economies of scale in public secondary schools in Bungoma County, Kenya. The study was guided by the classical economies of scale theory. The study adopted an embedded mixed-methods design, integrating quantitative and qualitative evidence from public secondary schools in Bungoma County. The target population was 376 principals of public secondary schools and the County Director of Education of Bungoma County. Stratified sampling was used to obtain a sample size of 194 principals of public secondary schools and the county director of education. The response rate for principals was 93.3% (181 principals). Quantitative data was analyzed using descriptive statistics and regression analysis across different secondary school categories. Qualitative data was generated through interviews with school principals and the county director of education, and analyzed thematically. The study examined academic program related expenditure, unit costs, academic program scaling decisions and the relationship between program provision and public secondary schools cost structures. Academic programs expenditure varied substantially across schools, ranging from KSh. 78.95 to KSh. 7,427.34 per student, with a mean of KSh. 1,131.50 and Standard deviation of 1,190.41. Further, 82.9% of schools reported reducing academic programs because of budgetary constraints. Regression results showed statistically significant positive relationships between program-related expenditure per student and unit cost across extra-county ($B = 0.266$, $t=2.432$, $p = 0.015$), county boarding ($B = 1.593$, $t=2.510$, $p = 0.004$), county day/boarding ($B = 0.611$, $t=3.919$, $p = 0.001$), and sub-county schools ($B = 0.200$, $t=3.803$, $p = 0.004$). Qualitative evidence explained these relationships in terms of specialized staffing, laboratories, equipment, instructional materials and low enrolment in particular academic program. Smaller secondary schools were especially vulnerable to high academic program costs because fixed and semi-fixed costs were distributed across relatively few learners. The findings challenge the assumption that expanding academic programs necessarily produces economies of scale. Academic program diversity can improve educational opportunity, but it can also raise unit costs when academic program expansion is not matched by adequate enrolment, funding and resource capacity. Economies of scale in public secondary education are therefore academic program-specific and dependent on a school rather than automatic consequences of school growth. This study argues for differentiated financing, flexible program implementation and resource-sharing mechanisms that allow smaller and less-resourced secondary schools to provide meaningful curricular opportunities without creating unsustainable cost burdens.

Keywords: Academic Program Diversity, Academic Programs, Economies of Scale, Public Secondary Education, Unit Cost

I. INTRODUCTION

Andrews et al. (2002) defined economies of scale as the percentage increase in output that results from a one percent increase in all inputs. Chakraborty et al. (2000) indicated that economies of scale occur when the average cost per unit goes down as output increases. This implies that when a school expands its output, fixed costs can be distributed across a larger number of learners, reducing the average cost of providing education. Ideally, therefore, larger schools should be able to provide education more efficiently than smaller schools. This basic assumption has affected decisions concerning school expansion, institutional consolidation, resource allocation and the organization of educational provision. Yet schools cannot be compared to a factory that produces specific commodity. According to the Ministry of Education (2020), secondary schools in Kenya offer a wide range of technical and pre-vocational subjects. These subjects include drawing and design, woodwork and aviation technology. It further reported that the programs require specialized workshops and equipment that in turn increases the cost of education. This implies that adding academic programs may increase educational opportunities while simultaneously increasing the cost of educating each learner.

Owen et al. (2007) found that institutions having 500 or more students can offer wide subject choice and lower unit costs; however, moderate economies of scale persist up to 1000 students and perhaps even beyond that point. They

further note that cost penalties can be very large when enrolment becomes too low. This is important in the understanding of the current secondary school arrangement in Kenya. The expansion and diversification of secondary school curriculum have increased the range of academic programs, technical, practical and elective learning opportunities expected to be available to learners. Such diversification is educationally desirable because learners differ in interests, abilities and aspirations. At the same time, program diversification creates additional demands for specialized teachers, laboratories, workshops, instructional materials and other facilities. These demands may be difficult to meet in schools with small enrolments or limited financial resources. The problem is therefore not simply whether schools are large or small. It is whether the scale of individual academic programs is sufficient to support their costs.

A public secondary school with a large overall enrolment may still experience diseconomies of scale if an academic program is taken by only a small number of learners. Alternatively, a smaller school may operate a particular academic program efficiently if it has adequate enrolment, shared facilities and appropriately allocated resources. This difference suggests that economies of scale in education should be examined not only at the level of the school, but also at the level of the academic program through which educational services are delivered. According to Stanislawski (2015), institutions that are large are able to offer wide course offerings and individualized support services such as mentoring and tutoring. This means that schools with stronger financial and infrastructural capacity may be able to offer a broader range of subjects, while schools serving relatively disadvantaged communities may be forced to reduce their program offerings. A narrow curriculum may lower immediate expenditure, but it may also reduce learners' access to technical, practical and elective learning opportunities. Thus, what appears to be cost efficiency from a financial perspective may represent under-provision from an educational perspective.

1.1 Statement of the Problem

Currently public secondary schools have academic programs with different staffing requirements, facilities, equipment, instructional materials and levels of student demand. This is evident with the report in the Basic Education Statistical Booklet (2020) which indicated that secondary schools in Kenya offer a wide range of technical and pre-vocational subjects. These subjects include drawing and design, woodwork and aviation technology. It further reported that the programs require specialized workshops and equipment that in turn increases the cost of education (Ministry of Education, 2020). This implies that adding academic programs may increase educational opportunities while simultaneously increasing the cost of educating each learner.

The introduction of free day secondary education led to increased expenditure in education. However, schools are still facing financial constraints due the budget cuts in the education sector. The education sector report, on medium term expenditure framework 2022/23-2024/25, indicates that the education sector is affected by serious budget cuts. Enrolment in learning and training institutions is not adequately funded due to low school capitation and delays in approving the cost of financing academic programs. Consequently, the infrastructure, facilities, and equipment provision, and right-sizing of critical human resources in schools are adversely affected, and pending bills stood at approximately Ksh. 57 billion as at June 2021 (Republic of Kenya, 2021). Due to these challenges, public secondary schools in Kenya continue to suffer from financial challenges. This is evident in various forms, including delays in hiring enough specialized teachers, carrying out symposiums, academic workshops and in carrying out maintenance of school buildings and equipment. Some academic programs in secondary schools may have few students but still consume a large share of the school's budget. This results in high academic program expenditure per student. Therefore, it is not clear whether resources in public secondary schools are spread too thinly across different academic programs in order to minimize the cost of education. Most of the existing literature have focused on the general cost of education, with limited attention on how the number of academic programs offered influences economies of scale. This study therefore, seeks to examine the relationship between academic program provision and economies of scale in public secondary schools in Bungoma County, Kenya. The study contributes to the literature by changing the argument from school size to the less examined issue of academic program-level scale. It argues that understanding educational efficiency requires attention to what schools offer, how many learners participate in each academic program, and the resources required to sustain those programs.

1.2 Research Question

What is the relationship between academic program provision and economies of scale in public secondary schools in Bungoma County, Kenya?

1.3 Research Hypothesis

H₀: There is no statistically significant relationship between academic program provision and economies of scale in public secondary schools in Bungoma County.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Classical Economies of Scale Theory

This study was based on the classical economies of scale theory developed by Adam Smith (1776). This theory postulates that the average unit cost of an organization decreases as the volume of output increases. In education, the unit cost is taken as the unit of output. Economies of scale occur at a school size where the lowest unit cost is incurred, and the resources required remain constant. The study used the cost function derived from the economies of scale theory, as shown below, to achieve the objective of the study.

$$X_1 = a + bX_2 + u$$

Where X_1 is the unit cost, X_2 is the number of academic programs offered and u is the error term. X_2 was measured in terms of academic expenditure per student.

Economies of scale suggest larger schools will be able to present a wider variety of optional subjects at a reduced cost per student. However, administrators' decisions regarding which subjects and pathways to offer may be affected by factors such as social pressures, parental expectations, or perceived prestige, rather than purely cost-minimizing reasons.

2.2 Empirical Review

Related studies provide meaningful evidence that institutional size influences educational costs, but the findings also demonstrate that the relationship is neither uniform nor linear. Werblow and Duesberry (2009) found that larger schools may enjoy cost advantages that enable them to provide a wider range of courses and co-curricular activities. Larger enrolments allow schools to spread fixed costs over more students and can make program diversification financially viable. Similarly, Stanislaski (2015) reported that institutional growth may increase the capacity to provide a broader range of courses and support services. These findings suggest that scale can create opportunities for educational diversification as well as financial efficiency. Owen et al. (2007), however, showed that low enrolment can produce substantial cost penalties. Schools with larger enrolments were better positioned to offer a wider range of pathways at lower unit costs, while small enrolments could result in substantially higher costs per learner. The cost of program provision also differs according to disciplinary characteristics. Jaworska (2015) found that the expansion of education in foreign languages showed a positive effect on the share of paid educational services in revenues from educational activities, resulting from an increase in the number of hours of language courses, leading to increase in salary expenses, hence the cost of education. Middaugh et al. (2003) demonstrated significant variation in instructional costs across academic disciplines. Tandberg and Hillman (2021) similarly showed that academic programs requiring specialized knowledge, equipment and facilities tend to be more expensive. Financial pressures can consequently lead educational institutions to rationalize their programs. Song and Boyer (2020) found that institutions facing budget challenges sometimes reduced or discontinued programs despite their educational value. Jackson et al. (2021) likewise found that schools respond to financial challenges by protecting core operations while reducing other activities. Similarly, Bissonnette et al. (2011) who noted that some schools had postponed scheduled maintenance and discontinued non-essential travel due to budget cuts. Giwa and Sheu (2022) noted that subjects like science and computing demand indivisible inputs—resources that, once acquired, can support multiple learning streams, thus potentially enhancing economies of scale if properly managed. The Basic Education Statistical Booklet (2020) indicated that the Kenyan secondary school curriculum offers a wide range of technical and pre-vocational subjects such as Drawing and Design, Woodwork, and Aviation Technology. These programs necessitate specialized workshops and equipment, which significantly increase the cost of delivery. Taken together, these studies suggest that program diversity creates both educational benefits and financial costs. However, relatively little attention has been paid to how these dynamics operate within public secondary schools in Kenya, particularly across different public secondary school categories and levels of enrolment. This study addresses this gap by examining how academic program-related expenditure and academic program scaling decisions relate to unit costs in public secondary schools in Bungoma County.

III. METHODOLOGY

3.1 Research Design

The study employed a mixed-methods research design. An embedded mixed-method design is a design in which one data set provides a supportive, secondary role in a study based primarily on the other data type (Creswell & Clark, 2007). This study embedded qualitative dataset within a quantitative. Quantitative analysis was used to establish patterns in academic program-related expenditure and their relationship with unit cost, while qualitative data was used to explain how school managers experienced and responded to financial challenges of different academic program provision. The use of the two sets of data enabled the study to explain and justify the school processes involving the observed cost patterns.

3.2 Study Area

The study was conducted in public secondary schools in Bungoma County, Kenya. Bungoma County has a total of thirteen sub-counties, namely: Bumula, Bungoma South, Bungoma West, Kimaeti, Bungoma Central, Bungoma East, Tongaren, Bungoma North, Kopsiro, Cheptais, Mt. Elgon, Kimilili, and Webuye West. Bungoma County has consistently recorded the highest secondary school enrolment in Kenya, with student numbers rising steadily from 153,688 in 2019 to 203,195 in 2023 (KNBS, 2024).

3.3 Target Population

The Population size was the county director of education and 376 public secondary school principals drawn from sixteen extra-county schools, ninety-five county schools, and two hundred and sixty five sub-county schools in the thirteen sub-counties.

3.4 Sampling and Sample Size

Stratified sampling was used in determining the sample size in the study because it gave an equal opportunity to all subjects in the target population to be selected for the study. Yamane (1967) formula was used to calculate and determine the study sample size. The sample size determined was 194 public secondary school principals. Stratified sampling was used to select schools in each sub-county. This ensured equal and unbiased chance of selection. In addition to sub-county stratification, the study also considered categories of schools which were treated as important sub-groups within the population. The categories existing within a sub-county were proportionally represented in the sample. The quantitative analysis was based on responses from 181 school principals, representing a response rate of 93.3% from the targeted participant sample. The sample size for each stratum was calculated using the stratified sample formula,

$$\text{Sub group sample size for each stratum} = \left(\frac{Nh}{N} \right) \times n,$$

Where, Nh-Population size of the stratum

N-Total population size

n-total target sample size

Additionally, a purposive sampling technique was used to select principals from secondary schools and the county director of education to be interviewed. According to Moser and Kalton (2017), purposive sampling selects participants based on specific information they hold.

Table 1

Stratification of Public Secondary Schools in Bungoma County

Sub-County	No. of Public Secondary Schools	Sample Size	Percentage (%)
Bungoma South	62	32	51.6
Bungoma West	31	16	51.6
Bumula	29	15	51.7
Kimaeti	20	10	50.0
Bungoma Central	44	22	50.0
Bungoma East	27	14	51.9
Tongaren	24	12	50.0
Bungoma North	29	15	51.7
Kopsiro	11	6	54.5
Cheptais	13	7	53.8
Mt. Elgon	19	10	52.6
Kimilili	33	17	51.5
Webuye West	34	18	52.9
Total	376	194	51.3

3.5 Data Collection Instruments and Procedures

The researcher used questionnaires and an interview schedule, supported by content analysis, to collect comprehensive and reliable data. Content validity was used to establish the validity of the research instruments. This was determined by the supervisors and other experts from the Department of Educational Management, University of Eldoret. They matched each item with the research questions in order to determine whether or not the instrument actually measured what it was supposed to measure. Reliability of the instruments was established using the test re-test method.

The instrument generated a Pearson's Product-Moment Correlation Co-efficient of 0.84; therefore, the instrument was considered reliable.

3.6 Data Analysis

Quantitative data were analyzed using descriptive statistics and regression analysis. Academic programs-related expenditure per student was examined in relation to unit cost across school categories. Qualitative interview data were analyzed thematically. The analysis focused on recurring explanations concerning academic program funding, staffing, enrolment, infrastructure, academic programs scaling, resource sharing and educational access. The mixed-methods findings were subsequently integrated to explain the statistical relationships in relation to the lived realities of school management. The unit cost was obtained by dividing the total expenditure incurred in a school in the year 2024 by the total number of students enrolled in 2024. Similarly, the total expenditure on academic programs in the year 2024 divided by the total enrolment in the given year gave the academic programs expenditure per student.

3.7 Ethical Consideration

The researcher sought for an introduction letter from the School of Education (University of Eldoret). The researcher then applied for a research permit from the National Council for Science and Technology (NACOSTI). After receiving the research permit from NACOSTI, the researcher visited the Bungoma county education' and county commissioner's offices to seek the letter of authorization to conduct research in Bungoma County. The researcher assured the respondents that the data collected from them was to be treated with confidentiality. The respondents were told why the study was being carried out and the importance of the study was also explained to respondents. The participation of respondents was voluntary. The respondents were not required to fill their names and the names of the schools in the questionnaire. This ensured that their identity was protected. The benefits of the study will be communicated, and recommendations will be implemented to benefit the participants and other members in the country.

To strengthen qualitative findings, oral data was integrated with quantitative data. The study ensured that all participant voices in this section are coded to ensure confidentiality. Principals were assigned anonymized identifiers based on school category and the sequence of the interview, for example:

CB-P1, CB-P2,... = County Boarding Principals

CDB-P1, CDB-P2... = County Day/Boarding Principals

SC-P1, SC-P2... = Sub-County Principals

1V. FINDINGS & DISCUSSION

4.1 Finding

4.1.1 Variation in Academic Program Expenditure

The study found substantial variation in academic programs expenditure across schools. Expenditure per student ranged from KSh. 78.95 to KSh. 7,427.34, with a mean of KSh. 1,131.50 and a Standard deviation of 1,190.41. The standard deviation is slightly higher than the mean, indicating that expenditure per student on academic programs vary significantly from one school to another. The magnitude of the range indicates that public secondary schools in Kenya operated under markedly different academic program financing conditions. The differences reflect variations in public secondary school category, enrolment, staffing, academic programs composition, infrastructure and the availability of financial resources. These variations raise serious concerns regarding equity and equality, the central pillars of Kenya's education policy. Low levels of academic expenditure per student undermine the objectives of the Competency-Based Education (CBE) and the Quality Assurance and Standards Framework, both of which assume minimum resource availability. The findings suggest that without targeted support, policy aspirations for quality learning outcomes may remain unattainable in resource-constrained schools. This finding agrees with Song and Boyer (2020) who established that some programs were struggling to survive due to budgetary constraints. They noted that administrators had set up a policy to phase out programs during a budget crisis, regardless of the value of each program.

Table 2

Independent Variable

	N	Minimum	Maximum	Mean	Std. Dev.
Amount Spent on Academic Programs per Student	181	78.95	7,427.34	1,131.4961	1,190.40881
Valid N (list-wise)	181				

4.1.2 Academic Programs Reduction in Response to Budget Constraints

A major finding in this study was the extent to which financial challenges determined academic programs provision in a school. Out of 181 schools sampled in this study, 150 (82.9%) reported that they had reduced academic programs because of budgetary constraints, while only 31 (17.1%) reported that they had not. This finding therefore suggests that

academic program depth is not determined mainly by curricular requirements or learner choices. The financial capacity of the school substantially influences which academic programs can actually be sustained. This finding is in agreement with Bissonnette et al. (2011) who noted that some schools had postponed scheduled maintenance and discontinued non-essential travel due to budget cuts. Jackson et al. (2021) likewise found that schools respond to financial challenges by protecting core operations while reducing other activities.

Table 3

Has your school scaled programs down due to budget concerns

	Frequency	Percent
YES	150	82.9
NO	31	17.1
Total	181	100.0

4.2 Regression Results

The regression analysis in this study revealed statistically significant positive relationships between academic programs-related expenditure per student and unit cost across all school categories. Since all p-values were below 0.05, the null hypothesis was rejected. Therefore, the results indicate that increases in a school academic program-related expenditure per student were associated with increases in the unit cost. The level of the relationship differed substantially across public secondary school categories, with county boarding secondary schools recording the largest coefficient.

Regression Analysis

The study tested the null hypothesis, which was stated as:

H_04 : There is no statistically significant relationship between the number of academic programs offered in a school and economies of scale in secondary schools in Bungoma County.

Results for extra-county schools displayed in Table 5 indicate that at the 95% confidence level, there exists a positive and statistically significant relationship between the number of academic programs and unit cost in Bungoma County ($B=.266$, $t=2.432$ and $p=0.015$).

Table 5

Linear Cost Function of Extra County Schools in Bungoma County

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	76948.753	25921.176		8.883	.000
Amount Spent on Academic Programs per Student (X_2)	.266	.109	.081	2.432	.015

Dependent Variable: Unit Cost (X_1)

Similarly, result for county boarding schools displayed in table 6 ($B=1.593$, $t=2.510$ and $p=0.004$) shows that there exists a positive and statistically significant relationship between the number of academic programs offered and unit cost.

Table 6

Linear Cost Function of County Boarding Secondary Schools in Bungoma County

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	114078.323	17033.373		6.697	.000
Amount Spent on Academic Programs per Student (X_2)	1.593	.635	.122	2.510	.004

Dependent Variable: Unit Cost (X_1)

At 95% confidence level, table 7 ($B=.611$, $t=3.919$ and $p=0.001$), indicates a positive and statistically significant relationship between the number of academic programs offered and the unit cost in sub-county secondary schools.

Table 7*Linear Cost Function of County Day/Boarding Schools in Bungoma County*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	52,275.556	2,807.924		18.617	.000
Amount Spent on Academic Programs per Student (X_2)	.611	.156	.150	3.919	.001

Dependent Variable: Unit Cost (X_1)

Table 8 ($B=.200$, $t=3.803$ and $p=0.004$) shows that there exists a positive and statistically significant relationship between the number of academic programs and unit cost in sub-county secondary schools. Since the p-value in all cases was less than the 0.05 level of significance, the null hypothesis was rejected.

Table 8*Linear Cost Function of Sub-County Secondary Schools in Bungoma County*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	45374.059	1519.774		29.856	.000
Amount Spent on Academic Programs per Student (X_2)	.200	.053	.054	3.803	.004

Dependent Variable: Unit Cost (X_1)

This implies that an increase in the amount spent on academic programs per student increases the unit cost. A one-unit increase in the amount spent on academic programs per student increases the unit cost by Ksh.0.266, Ksh. 1.593, Ksh. 0.611 and Ksh. 0.20 in extra-county, county boarding, county day/boarding, and sub-county secondary schools, respectively. This indicates discrepancies in the expenditure per student and availability of programs also means inequalities in the accessibility to electives and technical subjects for students in resource-limited schools, thus affecting the quality of education. County boarding incurred the highest increase in unit cost when the amount spent per student increased by one unit. The greater marginal impact in the county boarding schools reveals a greater need for school resources to offer diverse programs in boarding schools (e.g., laboratories, specialized teachers, school-specific equipment, etc.), while the lower per-pupil expenditure in sub-county schools is driven by even fewer and less diverse programs given their budget constraints. This finding agrees with Jaworska (2015) who found that the expansion of education in foreign languages showed a positive effect on the share of paid educational services in revenues from educational activities, resulting from an increase in the number of hours of language courses, leading to increase in salary expenses, hence the cost of education. In this case the foreign languages indicated increase in academic programs. The corresponding linear regression equations in this study were:

$$X_1 = 76948.753 + 0.266X_2$$

$$X_1 = 114078.323 + 1.593X_2$$

$$X_1 = 52,275.556 + 0.611X_2 \text{, and}$$

$X_1 = 45374.059 + 0.20X_2$ for extra-county, county boarding, county day/boarding and sub-county schools respectively.

It was observed that the more quantitative quality of programs does not just depend with quantitative size of students; but it depends on the number of programs offered additional to their size because in addition to students' size, the basic factors of production such as staffing, instructional materials, and facilities would be increased with additional programs offered and are semi-fixed in nature. This concurs with the finding by Middaugh et al. (2003), which also suggested a variation in instructional costs between disciplines, and costs were always higher for STEM courses and courses that required instruction-intensive non-STEM disciplines (such as education, art, nursing). In a similar manner, Tandberg and Hillman (2021) discovered that certain particular courses, such as medicine, law, or engineering, are higher in cost than others. This is because they need more advanced knowledge and training, and this has a knock-on effect on the money that is paid.

4.3 Qualitative Findings

4.3.1 Financial Capacity Determines Academic Programs Breadth

Principals in secondary schools with challenges with resources reported that financial barriers prevented them from offering some academic programs even where learners expressed interest. One sub-county secondary school principal explained:

"I wish to add subjects such as Aviation, German and Art and Design but we have no funds to keep the subject going as there is no teacher for it and in some cases lab facilities." (SC-P8, 9th October, 2025)

The statement presents a common issue in secondary schools that academic programs availability depends not only on curricular demand but also on the capacity by the school to finance teachers as well as the available school facilities. This finding concurs with Song and Boyer (2020) who noted that administrators had set up a policy to phase out programs during a budget crisis, regardless of the value of each program.

A county boarding secondary school principal offered a different response:

“Here in our school, parents pay more fees without complaining, and we also receive a percentage of government funding as a result, which means we can provide more academic programs options and elective subjects. However, it makes our cost of operation per student higher in that we have to support a variety of laboratory activities and have different teachers to support different subjects.” (CB-P1, 13th October, 2025)

The two reports indicate the difference management experiences in schools. The schools with higher financial capacity enable them to offer more pathways, but the additional pathways also create additional costs. The finding agrees with Owen et al. (2007) who found that low enrolment can produce substantial cost penalties. Schools with larger enrolments were better positioned to offer a wider range of pathways at lower unit costs, while small enrolments could result in substantially higher costs per learner. The cost of program provision also differs according to disciplinary characteristics. The above confessions from a sub-county secondary principal and the county boarding principal reveal inequality in allocation of resources and breadth of programs across school categories, which in turn results in inequity in student learning opportunities. In less resourced or smaller schools, low expenditure per pupil has direct implications for quality because the lack of resources impacts the provision of practical, skills-based and elective provision. This mirrors the concerns of Kenya's Competency-Based Education (CBE) system, which assumes a certain minimum amount of resources to attain the intended learning outcomes. These results reinforce those of Stanislawski (2015) confirmed this notion; as institutions grew, their ability to provide a wider spread of courses increased, and there was a wider spread of support services, e.g., mentoring and tutoring. He was a strong proponent of smaller schools being consolidated to gain cost-effectiveness.

4.3.2 Budget Constraints and Academic Program Reduction

The quantitative finding in this study shows that 82.9% of public secondary schools had reduced academic programs as illustrated by one principal who noted:

“It's inhumane to cut academic school programs that are for the sake of the child. We have students that want to take science, technology and creative art classes, but we can't offer them because it would cost too much per pupil.” (SC-P5, 15th October, 2025)

Another secondary school principal mentioned:

“We have reduced the number of internal school examinations and external symposiums... We attend only to academic programs that we can afford.” (SC-P4, 15th October, 2025)

These confessions indicate that academic programs reduction is often a means of survival. Schools make effort to maintain financial sustainability by prioritizing academic programs that are believed affordable and essential. This finding concurs with Jackson et al. (2021), who observed that school districts responded to budget limitations by doing away with non-core operations in relation to spending first. They also reported that school districts minimized budget cuts to core operating expenditures, but did have to cut such expenditures.

4.3.3 Low Enrolment and Academic Program-Level Diseconomies

The study further shows that low enrolment in secondary schools in individual academic programs is a major reason for diseconomies of scale. A sub-county secondary principal mentioned:

“A school cost efficiency is not even possible for offering a subject to just five students; labs, materials, etc. which are not used.” (SC-P3, 16th October, 2025)

This observation is particularly important because it demonstrates why aggregate secondary school enrolment can provide an incomplete picture of economies of scale. A school may have a relatively large total enrolment while still operating several academic programs with very small class sizes. Where a secondary school academic program requires specialized subject teachers, facilities and equipment, low secondary school enrolment means that these costs are distributed over relatively few learners, increasing the cost per student in a senior school. This is in agreement with Owen et al. (2007) found that cost penalties can be very large when enrolment becomes too low; for instance, unit costs may be twice as high with 100 students as with 500, if comparable subject choice is offered.

Managerial Responses: Secondary school principals reported several strategies dealing with academic program costs. These included sharing practical classes, maximizing school facility use, adjusting timetables and temporarily suspending academic programs with low demand. A county day/boarding secondary school principal observed:

“Some essential form three practical classes are shared, and teachers change subject periodically... this reduces the cost per student; but places the challenge on the teachers.” (CDB-P2, 22nd October, 2025)

The finding shows an important economic aspect that resource sharing may reduce financial costs, but it can shift pressure to teachers through increased workload and more straining timetabling. These managerial strategies demonstrate that schools are actively negotiating between financial efficiency, pedagogical breadth, and compliance with national curriculum requirements. However, they are reactive rather than proactive, often addressing cost pressures rather than systematically optimizing program scale. On policy implications, the findings reveal critical gaps. While the Ministry of Education prescribes minimum program offerings, it does not provide sufficient flexibility or targeted funding for schools with low enrolment or limited resources.

Equity Implications: Secondary school academic programs related economies of scale also have a direct effect on educational equity and quality. A sub-county secondary school principal observed:

“Students in this school do not have the opportunity to be taught technical or elective subjects which we are unable to sustain due to limited resources this is not the same as in well-resourced urban schools.”
(SC-P8, 24th October, 2025)

This finding in this study suggests that differences in academic program financing in public secondary schools can lead into differences in educational opportunity. Secondary schools with bigger financial capacity can sustain many academic programs, while resource challenged schools may offer few academic programs. This is in agreement with Tandberg and Hillman (2021) who showed that academic programs requiring specialized knowledge, equipment and facilities tend to be more expensive. Financial pressures can consequently lead educational institutions to rationalize their programs. Qualitative evidence in the present study reinforces the quantitative differences in per pupil spending and emphasizes that economies of scale cannot be taken at the price of equitable access to quality education.

4.5 Implications for Policy and Practice

The findings have four major implications. First, Financing should recognize the nature of academic program recognizing that academic programs differ in cost. A uniform per-student allocation may disadvantage schools offering external symposiums, workshops, academic tours, resource-intensive science, technical and practical pathways. Per-student expenditures and unit cost are higher with expansion in programs, and the extent of that will depend on the type of school, the size of the school, and what resources are available to support the expansion. Second, academic programs planning should consider enrolment per academic programs. Schools should assess academic programs success using academic programs-specific enrolment rather than relying on total school enrolment. Thirdly, resource sharing should be strengthened in smaller schools which could improve academic programs efficiency through shared laboratories, workshops, specialized teachers and other facilities, particularly where schools are geographically close. Lastly, Efficiency should not be pursued at the expense of equity and quality. Reducing academic programs can lower expenditure, but it may also reduce educational opportunity as well as quality. Policy interventions should therefore seek to achieve cost-effectiveness while protecting learners' access to relevant and meaningful curriculum.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study demonstrates that the relationship between academic program provision and economies of scale in public secondary schools is significant and differs depending on the school.

More academic programs can expand educational opportunities and enable schools to respond to learners' interests and aspirations. However, academic programs expansion also carries financial implications. Where additional academic programs require specialized teachers, laboratories, equipment, transportation cost and instructional materials without sufficient enrolment or funding, unit costs increase and diseconomies of scale emerge. The finding that 82.9% of schools reduced academic programs due to budgetary challenges underscores the severity of financial constraints on curricular breadth. A reduction in scale is often an answer to a budget crunch, especially at the sub-county and small school level, yet it can impact quality and equity. More importantly, the study shows that low academic programs expenditure should not automatically be interpreted as efficiency. In some schools, low expenditure reflects limited academic programs provision rather than effective resource utilization. The study therefore advances the argument that economies of scale in education are academic program-specific rather than simply school specific. The optimal scale of a school depends not only on its total enrolment but also on the number of learners who have chosen an academic program, the intensity of resources required, and the school's capacity to finance and manage those resources.

5.2 Recommendations

Based on the findings of this study, the ministry of education, semi-autonomous agencies and the parliament should develop a policy that provides differentiated support for resource-intensive academic programs. They should also encourage appropriate resource sharing. Lastly, they should allow sufficient flexibility for schools to align academic program provision with enrolment and institutional capacity.



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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